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In the Supreme Court of the United States

ALLOC, INC., BERRY FINANCE N.V.,
and VÄLINGE INNOVATIONS AB,
fka VÄLINGE ALUMINIUM, AB,
Petitioners,

v.

INTERNATIONAL TRADE COMMISSION, and
PERGO, INC., and ROYSOL, and
AKZENTA PANEELE + PROFILE GmbH,
and UNILIN DÉCOR N.V., BHK OF AMERICA,
and MEISTER-LEISTEN SCHULTE, GmbH,
Respondents.

On Petition for a Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

APPENDICES E-L to PETITION FOR WRIT OF CERTIORARI

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Appendix 1a

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APPENDIX E

UNITED STATES PATENT

Patent No. 6,023,907

See Fold Out Exhibit
Diagrams

US006023907A

United States Patent [19]

Pervan

[11] Patent Number: 6,023,907

[45] Date of Patent: *Feb. 15, 2000

[54] **METHOD FOR JOINING BUILDING BOARDS**

[75] Inventor: **Tony Pervan**, Solna, Sweden

[73] Assignee: **Välinge Aluminium AB**, Viken, Sweden

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/193,687**

[22] Filed: **Nov. 18, 1998**

Related U.S. Application Data

[60] Continuation of application No. 09/003,499, Jan. 6, 1998, Pat. No. 5,860,267, which is a division of application No. 08/436,224, May 17, 1995, Pat. No. 5,706,621, and a continuation of application No. PCT/SE94/00386, Apr. 29, 1994.

[30] **Foreign Application Priority Data**

May 10, 1993 [SE] Sweden 9301595

[51] **Int. Cl.**[7] **E04B 1/12**

[52] **U.S. Cl.** **52/748.1**; 52/747.1; 52/747.11; 52/403.1; 52/480; 52/506.05; 52/551; 52/582.1; 52/592.2

[58] **Field of Search** 52/480, 550, 551, 52/506.05, 403.1, 745.05, 745.21, 747.1, 747.11, 748.1, 582.1, 591.3, 592.2

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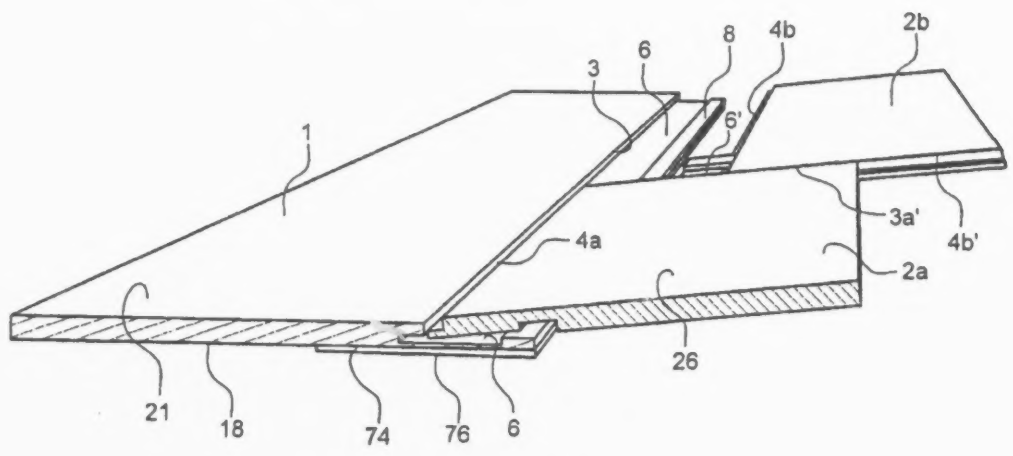
Assistant Examiner—Yvonne Horton-Richardson
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis, L.L.P.

[57] **ABSTRACT**

The invention relates to a system for laying and mechanically joining building panels, especially thin, hard, floating floors. Adjacent joint edges **(3, 4)** of two panels **(1, 2)** engage each other to provide a first mechanical connection locking the joint edges **(3, 4)** in a first direction **(D1)** perpendicular to the principal plane of the panels. In each joint, there is further provided a strip **(6)** which is integrated with one joint edge **(3)** and which projects behind the other joint edge **(4)**. The strip **(6)** has an upwardly protruding locking element **(8)** engaging in a locking groove **(14)** in the rear side **(16)** of the other joint edge **(4)** to form a second mechanical connection locking the panels **(1, 2)** in a second direction **(D2)** parallel to the principal plane of the panels and at right angles to the joint. Both the first and the second mechanical connection allow mutual displacement of joined panels **(1, 2)** in the direction of the joint.

14 Claims, 6 Drawing Sheets



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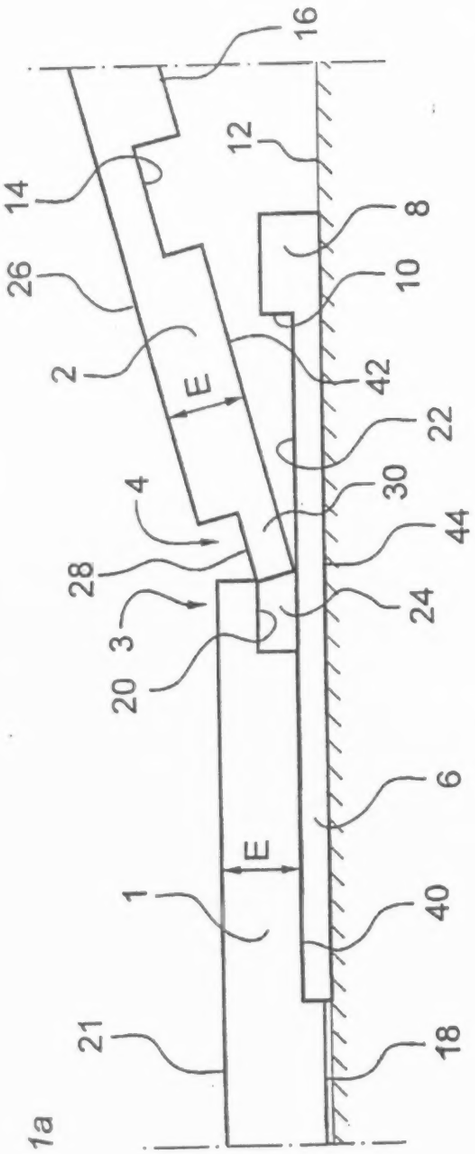
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Fig. 1a

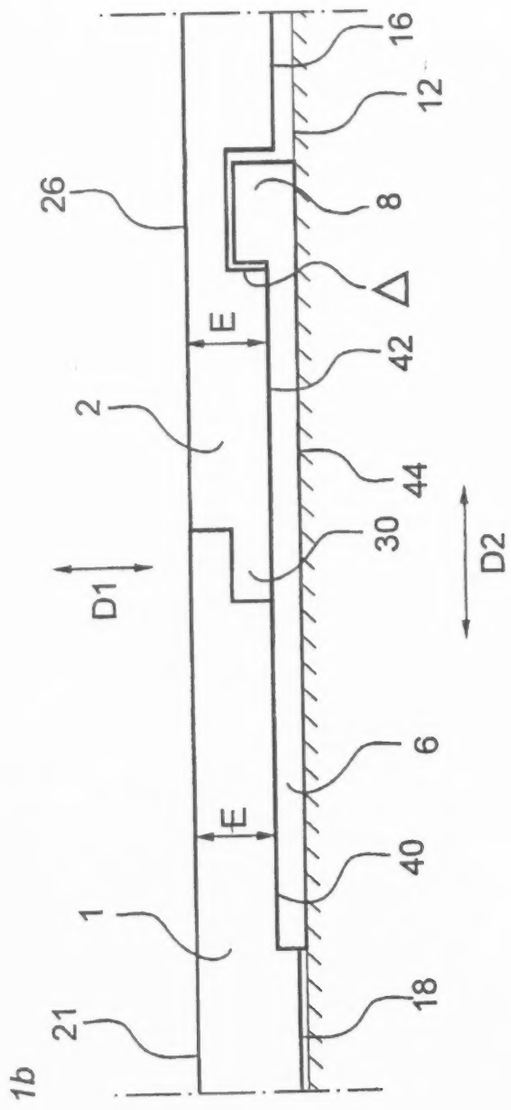
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Fig. 1b

Fig. 2a

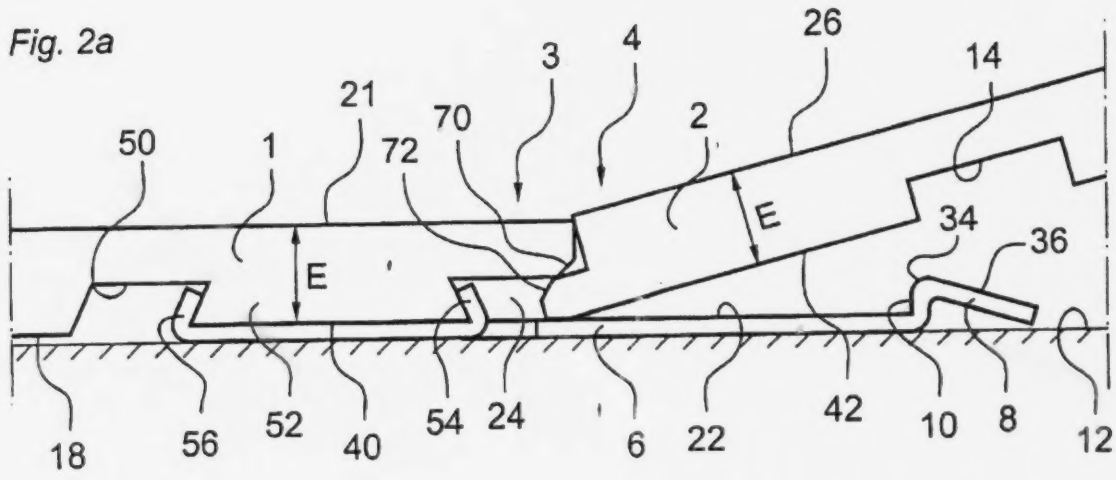


Fig. 2b

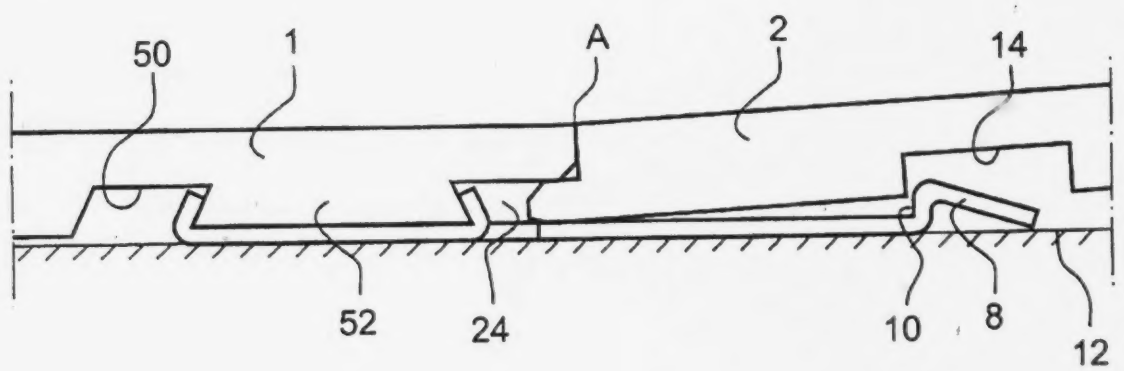


Fig. 2c

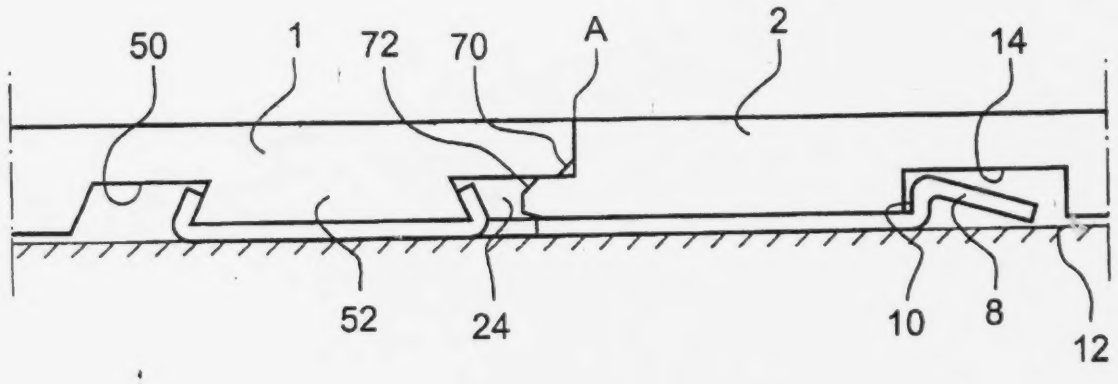


Fig. 3a

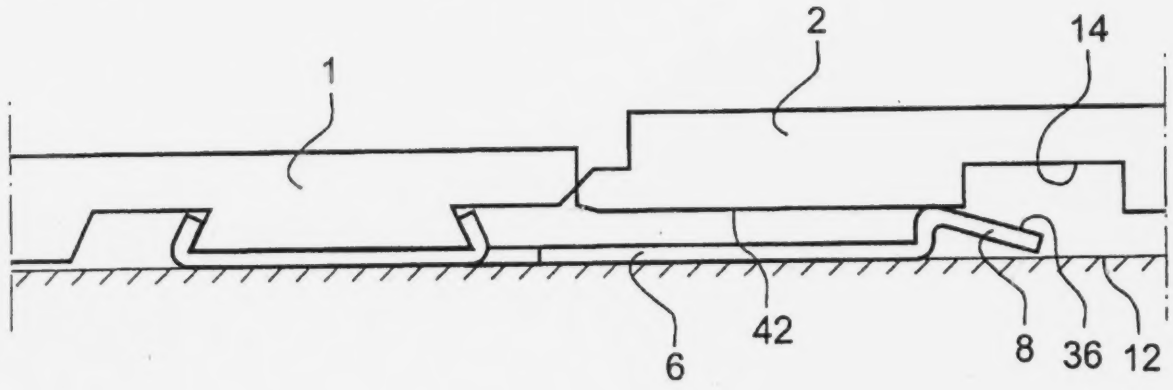


Fig. 3b

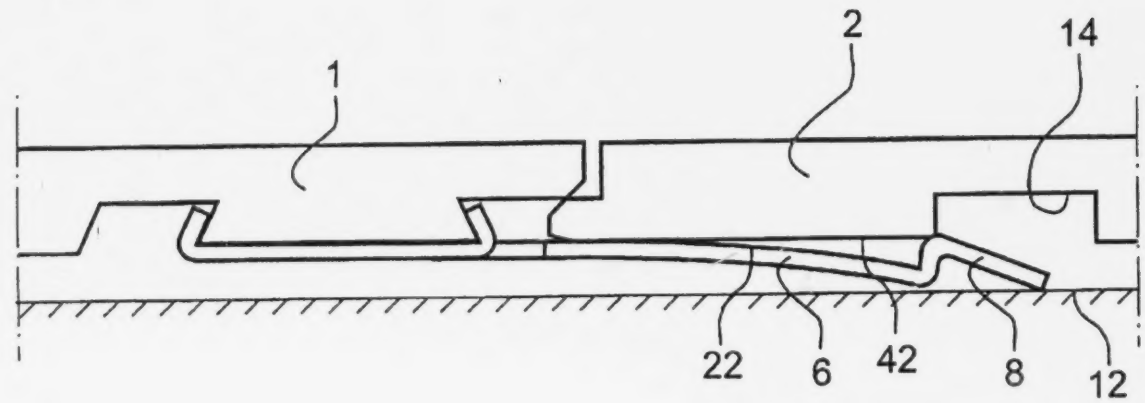


Fig. 3c

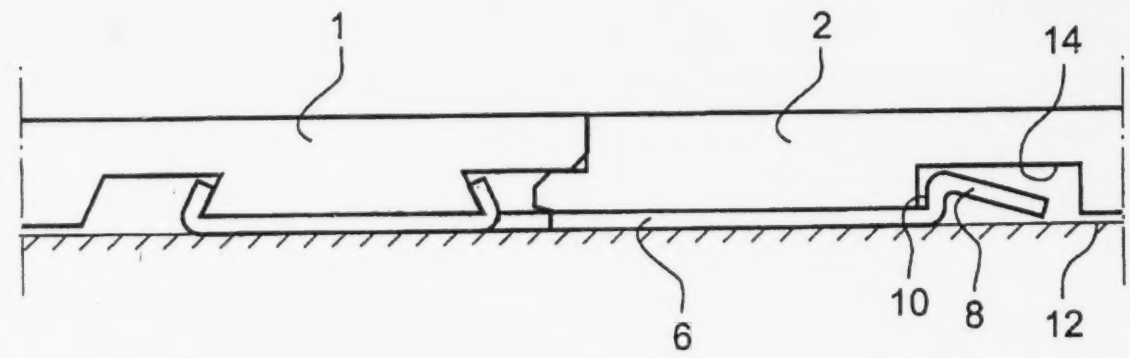


Fig. 4a

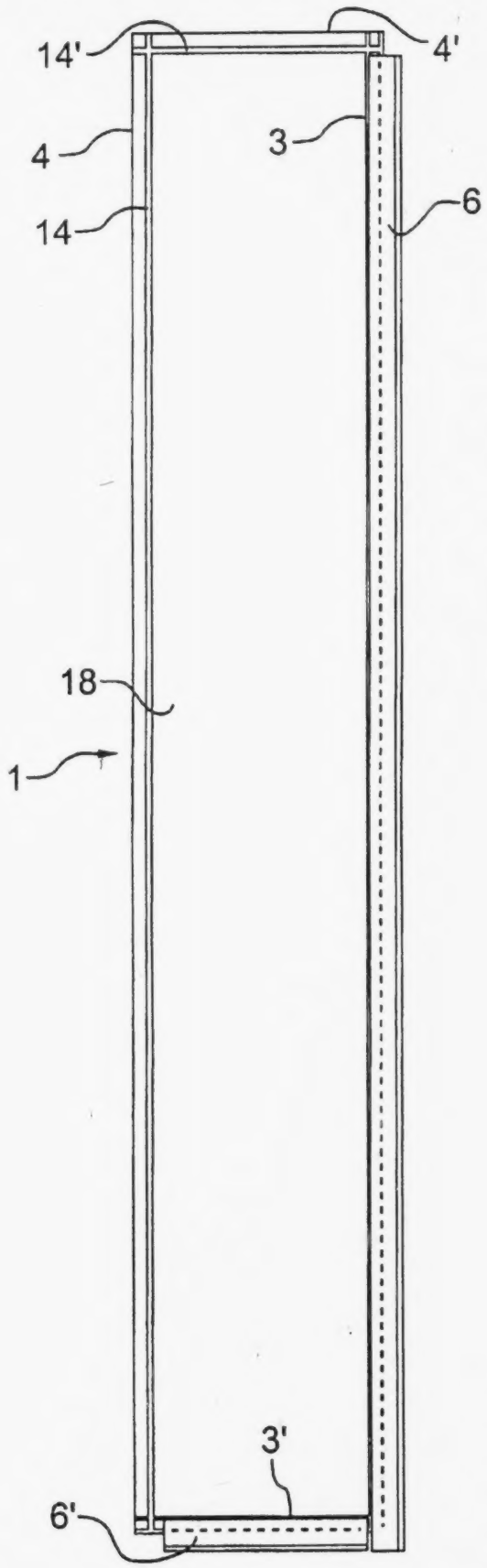
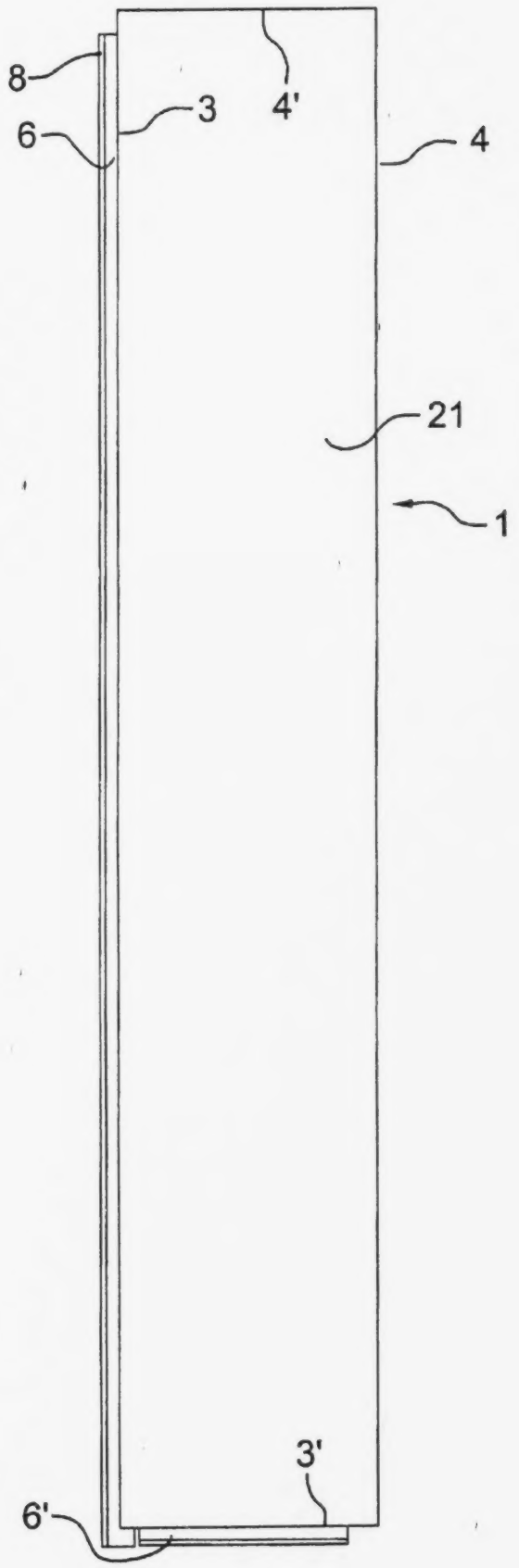


Fig. 4b



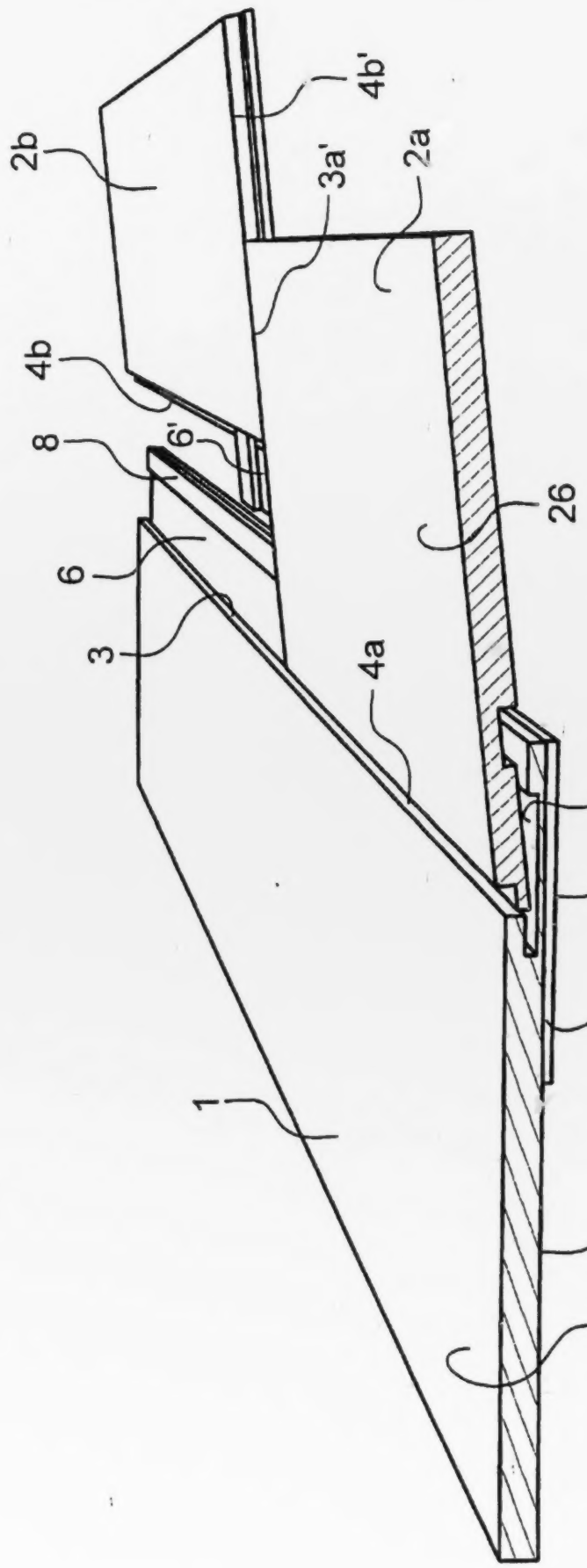


Fig. 5

Fig. 6

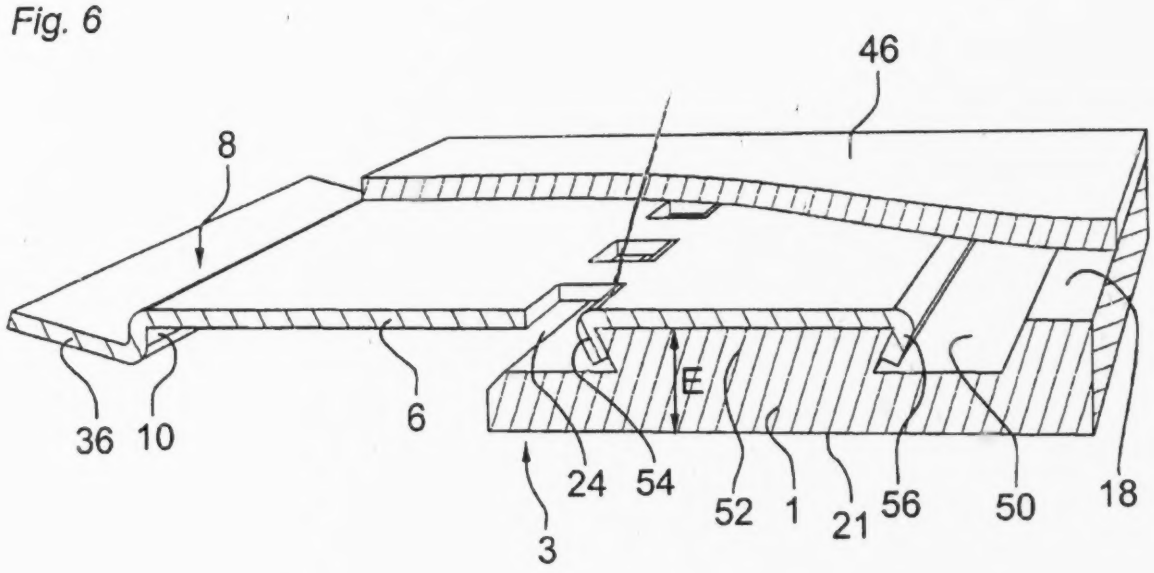
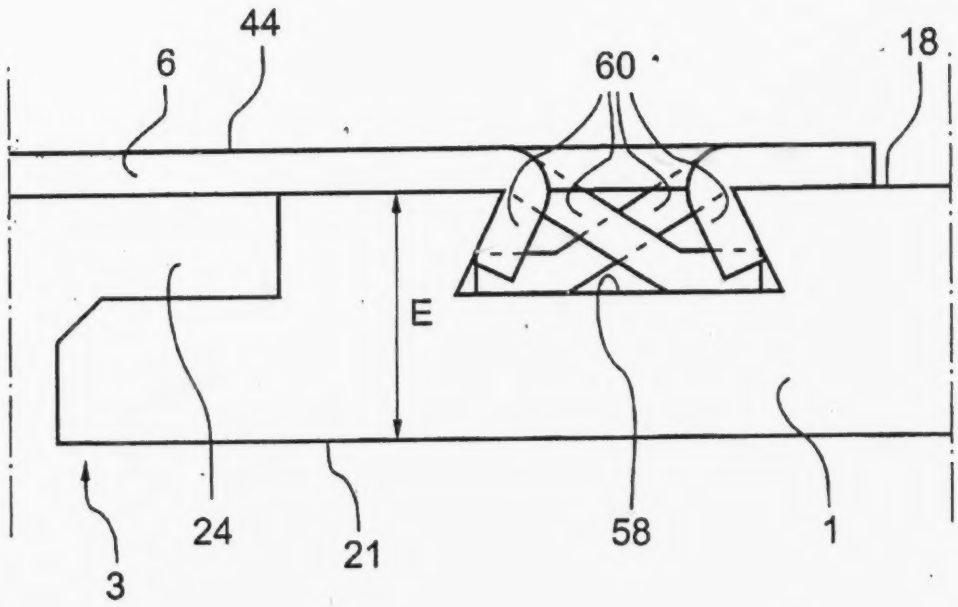


Fig. 7



6,023,907

[1]

METHOD FOR JOINING BUILDING BOARDS

This application is a continuation of application Ser. No. 09/003,499, filed Jan. 6, 1998, now U.S. Pat. No. 5,860,267, [5] which is a divisional of application Ser. No. 08/436,224 filed on May 17, 1995, now U.S. Pat. No. 5,706,621 and a continuation of PCT/SE94/00386 filed on Apr. 29, 1994.

TECHNICAL FIELD [10]

The invention generally relates to a system for providing a joint along adjacent joint edges of two building panels, especially floor panels.

More specifically, the joint is of the type where the adjacent joint edges together form a first mechanical connection [15] locking the joint edges to each other in a first direction at right angles to the principal plane of the panels, and where a locking device forms a second mechanical connection locking the panels to each other in a second direction parallel to the principal plane and at right angles [20] to the joint edges. The locking device comprising a locking groove which extends parallel to and spaced from the joint edge of one of the panels, and said locking groove being open at the rear side of this one panel.

The invention is especially well suited for use in joining [25] floor panels, especially thin laminated floors. Thus, the following description of the prior art and of the objects and features of the invention will be focused on this field of use. It should however be emphasized that the invention is useful

also for joining ordinary wooden floors as well as other types [30] of building panels, such as wall panels and roof slabs.

BACKGROUND OF THE INVENTION

A joint of the aforementioned type is known e.g. from SE [35] 450,141. The first mechanical connection is achieved by means of joint edges having tongues and grooves. The locking device for the second mechanical connection comprises two oblique locking grooves, one in the rear side of each panel, and a plurality of spaced-apart spring clips [40] which are distributed along the joint and the legs of which are pressed into the grooves, and which are biased so as to tightly clamp the floor panels together. Such a joining technique is especially useful for joining thick floor panels to form surfaces of a considerable expanse. [45]

Thin floor panels of a thickness of about 7-10 mm, especially laminated floors, have in a short time taken a substantial share of the market. All thin floor panels employed are laid as "floating floors" without being attached to the supporting structure. As a rule, the dimension of the [50] floor panels is 200x1200 mm, and their long and short sides are formed with tongues and grooves. Traditionally, the floor is assembled by applying glue in the groove and forming the floor panels together. The tongue is then glued in the groove of the other panel. As a role, a laminated floor consists of an [55] upper decorative wear layer of laminate having a thickness of about 1 mm, an intermediate core of particle board or other board, and a base layer to balance the construction. The core has essentially poorer properties than the laminate, e.g. in respect of hardness and water resistance, bit it is [60] nonetheless needed primarily for providing a groove and tongue for assemblage. This means that the overall thickness must be at least about 7 mm. These known

laminated floors using glued tongue-and-groove joints however suffer from several inconveniences. [65]

First, the requirement of an overall thickness of at least about 7 mm entails an undesirable restraint in connection

[2]

with the laying of the floor, since it is easier to cope with low thresholds when using thin floor panels, and doors must often be adjusted in height to come clear of the floor laid. Moreover, manufacturing costs are directly linked with the consumption of material. [5]

Second, the core must be made of moisture-absorbent material to permit using water-based glues when laying the floor. Therefore, it is not possible to make the floors thinner using so-called compact laminate, because of the absence of suitable gluing methods for such non-moisture-absorbent [10] core materials.

Third, since the laminate layer of the laminated floors is highly wear-resistant, tool wear is a major problem when working the surface in connection with the formation of the tongue. [15]

Fourth, the strength of the joint, based on a glued tongue-and-groove connection, is restricted by the properties of the core and of the glue as well as by the depth and height of the groove. The laying quality is entirely dependent on the gluing. In the event of poor gluing, the joint will open as a [20] result of the tensile stresses which occur e.g. in connection with a change in air humidity.

Fifth, laying a floor with glued tongue-and-groove joints is time-consuming, in that glue must be applied to every panel on both the long and short sides thereof. [25]

Sixth, it is not possible to disassemble a glued floor once laid, without having to break up the joints. Floor panels that have been taken up cannot therefore be used again. This is a

drawback particularly in rental houses where the flat concerned must be put back into the initial state of occupancy. [30] Nor can damaged or worn-out panels be replaced without extensive efforts, which would be particularly desirable on public premises and other areas where parts of the floor are subjected to great wear.

Seventh, known laminated floors are not suited for such [35] use as involves a considerable risk of moisture penetrating down into the moisture-sensitive core.

Eighth, present-day hard, floating floors require, prior to laying the floor panels on hard subfloors, the laying of a separate underlay of floor board, felt, foam or the like, which [40] is to damp impact sounds and to make the floor more pleasant to walk on. The placement of the underlay is a complicated operation, since the underlay must be placed in edge-to-edge fashion. Different underlays affect the properties of the floor. [45]

There is thus a strongly-felt need to overcome the above-mentioned drawbacks of the prior art. It is however not possible simply to use the known joining technique with glued tongues and grooves for very thin floors, e.g. with floor thicknesses of about 3 mm, since a joint based on a [50] tongue-and-groove connection would not be sufficiently strong and practically impossible to produce for such thin floors. Nor are any other known joining techniques usable for such thin floors. Another reason why the making of thin floors from e.g. compact laminate involves problems is the [55] thickness tolerances of the panels, being about 0.2-0.3 mm for a panel thickness of about 3 mm. A 3-mm compact laminate panel having such a thickness tolerance would have, in ground to uniform thickness on its rear side, an unsymmetrical design, entailing the risk of bulging. [60] Moreover, if the panels have different thicknesses, this also means that the joint will be subjected to excessive load.

Nor is it possible to overcome the above-mentioned problems by using double-adhesive tape or the like on the undersides of the panels, since such a connection catches [65] directly and does not allow for subsequent adjustment of the panels as is the case with ordinary gluing.

[3]

Using U-shaped clips of the type disclosed in the above-mentioned SE 450.141, or similar techniques to overcome the drawbacks discussed above is no viable alternative either. Especially, biased clips of this type cannot be used for joining panels of such a small thickness as 3 mm. Normally, [5] it is not possible to disassemble the floor panels without having access to their undersides. This known technology relying on clips suffers from the additional drawbacks:

Subsequent adjustment of the panels in their longitudinal direction is a complicated operation in connection with [10] laying, since the clips urge the panels tightly against each other. Floor laying using clips is time-consuming.

This technique is usable only in those cases where the floor panels are resting on underlying joists with the [15] clips placed there between. For thin floors to be laid on a continuous, flat supporting structure, such clips cannot be used.

The floor panels can be joined together only at their long sides. No clip connection is provided on the short sides. [20]

TECHNICAL PROBLEMS AND OBJECTS OF THE INVENTION

A main object of the invention therefore is to provide a system for joining together building panels, especially floor

[25] panels for hard, floating floors, which allows using floor panels of a smaller overall thickness than present-day floor panels.

A particular object of the invention is to provide a panel-joining system which [30]

makes it possible in a simple, cheap and rational way to provide a joint between floor panels without requiring the use of glue, especially a joint based primarily only on mechanical connections between the panels; [35]

can be used for joining floor panels which have a smaller thickness than present-day laminated floors and which have, because of the use of a different core material, superior properties than present-day floors even at a thickness of 3 mm; [40]

makes it possible between thin floor panels to provide a joint that eliminates any unevennesses in the joint because of thickness tolerances of the panels;

allows joining all the edges of the panels;

reduces tool wear when manufacturing floor panels with [45] hard surface layers;

allows repeated disassembly and reassembly of a floor previously laid, without causing damage to the panels, while ensuring high laying quality;

makes it possible to provide moisture-proof floors; [50]

makes it possible to obviate the need of accurate, separate placement of an underlay before laying the floor panels; and

considerably cuts the time for joining the panels.

These and other objects of the invention are achieved by [55] means of a panel-joining system having the features recited in the appended claims.

Thus, the invention provides a system for making a joint along adjacent joint edges of two building panels, especially floor panels, in which joint: [60]

the adjacent joint edges together form a first mechanical connection locking the joint edges to each other in a first direction at right angles to the principal plane of the panels, and

a locking device arranged on the rear side of the panels [65] forms a second mechanical connection locking the panels to

each other in a second direction parallel to the principal plane and at right angles to the joint edges, said locking device comprising a locking groove which extends parallel to and spaced from the joint edge of one of said panels, termed groove panel, and which is open at the rear side of [5] the groove panel, said system being characterized in.

that the locking device further comprises a strip integrated with the other of said panels, termed strip panel, said strip extending throughout substantially the entire length of the joint edge of the strip panel and being provided with a [10] locking element projecting from the strip, such that when the panels are joined together, the strip projects on the rear side of the groove panel with its locking element received in the locking groove of the groove panel, that the panels, when joined together, can occupy a [15] relative position in said second direction where a play exists between the locking groove and a locking surface on the locking element that is facing the joint edges and is operative in said second mechanical connection,

that the first and the second mechanical connection both [20] allow mutual displacement of the panels in the direction of the joint edges, and

that the second mechanical connection is so conceived as to allow the locking element to leave the locking groove if the groove panel is turned about its joint edge angularly [25] away from the strip.

The term "rear side" as used above be considered to comprise any side of the panel located behind underneath the front side of the panel. The opening plane of the locking groove of the groove panel can thus be located at a distance [30] from the rear surface of the panel resting on the supporting structure. Moreover, the strip, which in the invention extends throughout substantially the entire length of the joint edge of the strip panel should be considered to encompass both the case where the strip is continuous, uninterrupted [35] element, and the case where the "strip" consists in its longitudinal direction of several parts, together covering the main portion of the joint edge.

It should also be noted (i) that it is the first and the second mechanical connection as such that permit mutual displacement [40] of the panels in the direction of the joint edges, and that (ii) it is the second mechanical connection as such that permits the locking element to leave the locking groove if the groove panel is turned about its joint edge angularly away from the strip. Within the scope of the invention, there [45] may thus exist means, such as glue and mechanical devices, that can counteract or prevent such displacement and/or upward angling.

The system according to the invention makes it possible to provide concealed, precise locking of both the short and [50] long sides of the panels in hard, thin floors. The floor panels can be quickly and conveniently disassembled in the reverse order of laying without any risk of damage to the panels, ensuring at the same time a high laying quality. The panels can be assembled and disassembled much faster than in [55] present-day systems, and any damaged or worn-out panels can be replaced by taking up and re-laying parts of the floor.

According to an especially preferred embodiment of the invention, a system is provided which permits precise joining of thin floor panels having, for example, a thickness of [60] the order of 3 mm and which at the same time provides a tolerance-independent smooth top face at the joint. To this end, the strip is mounted in an equalizing groove which is countersunk in the rear side of the strip panel and which exhibits an exact, predetermined distance from its bottom to [65] the front side of the strip panel. The part of the strip projecting behind the groove panel engages a corresponding

[5]

equalizing groove, which is countersunk in the rear side of the groove panel and which exhibits the same exact, predetermined distance from its bottom to the front side of the groove panel. The thickness of the strip then is at least so great that the rear side of the strip is flush with, and [5] preferably projects slightly below the rear side of the panels. In this embodiment, the panels will always rest, in the joint, with their equalizing grooves on a strip. This levels out the tolerance and imparts the necessary strength to the joint. The strip transmits horizontal and upwardly-directed forces to [6] the panels and downwardly-directed forces to the existing subfloor.

Preferably, the strip may consist of a material which is flexible, resilient and strong, and can be sawn. A preferred strip material is sheet aluminium. In an aluminium strip, [15] sufficient strength can be achieved with a strip thickness of the order of 0.5 mm.

In order to permit taking up previously laid, joined floor panels in a simple way, a preferred embodiment of the invention is characterized in that when the groove panel is [20] pressed against the strip panel in the second direction and is turned anglularly away from the strip, the maximum

distance between the axis of rotation of the groove panel and the locking surface of the locking groove closest to the joint edges is such that the locking element can leave the locking [25] groove without contacting the locking surface of the locking groove. Such a disassembly can be achieved even if the aforementioned play between the locking groove and the locking surface is not greater than 0.2 mm.

According to the invention, the locking surface of the [30] locking element is able to provide a sufficient locking function even with very small heights of the locking surface. Efficient locking of 3-mm floor panels can be achieved with a locking surface that is as low as 2 mm. Even if a 0.5-mm-high locking surface may provide sufficient locking. [35] The term "locking surface" as used herein relates to the part of the locking element engaging the locking groove to form the second mechanical connection.

For optimal function of the invention, the strip and the locking element should be formed on the strip panel with [40] high precision. Especially, the locking surface of the locking element should be located at an exact distance from the joint edge of the strip panel.

Furthermore, the extent of the engagement in the floor panels should be minimised, since it reduces the floor [45] strength.

By known manufacturing methods, it is possible to produce a strip with a locking pin, for example by extruding aluminium or plastics into a suitable section, which is thereafter glued to the floor panel or is inserted in special [50] grooves. These and all other traditional methods do however not ensure optimum function and an optimum level of economy. To product the joint system according to the invention, the strip is suitably formed from sheet aluminium, and is mechanically fixed to the strip panel. [55]

The laying of the panels can be performed by first placing the strip panel on the subfloor and then moving the groove

panel with its long side up to the long side of the strip panel, at an angle between the principal plane of the groove panel and the subfloor. When the joint edges have been brought [60] into engagement with each other to form the first mechanical connection, the groove panel is angled down so as to accommodate the locking element in the locking groove.

Laying can also be performed by first placing both the strip panel and the groove panel flat on the subfloor and then [65] joining the panels parallel to their principal planes while bending the strip downwards until the locking element snaps

[6]

up into the locking groove. This laying technique enables in particular mechanical locking of both the short and long sides of the floor panels. For example, the long sides can be joined together by using the first laying technique with downward angling of the groove panel, while the short sides [5] are subsequently joined together by displacing the groove panel in its longitudinal direction until its short side is pressed on and locked to the short side of an adjacent panel in the same row.

In connection with their manufacture, the floor panels [10] can be provided with an underlay of e.g. floor board, foam or felt. The underlay should preferably cover the strip such that the joint between the underlays is offset in relation to the joint between the floor panels.

The above and other features and advantages of the [15] invention will appear from the appended claims and the following description of embodiments of the invention.

The invention will now be described in more detail hereinbelow with reference to the accompanying drawing Figure. [20]

DESCRIPTION OF DRAWING FIGURES

FIGS. **1***a* and **1***b* schematically show in two stages how two floor panels of different thickness are joined together in floating fashion according to a first embodiment of the [25] invention.

FIGS. **2***a-c* show in three stages a method for mechanically joining two floor panels according to a second embodiment of the invention.

FIGS. **3***a-c* show in three stages another method for [30] mechanically joining the floor panels of FIGS. **2***a-c*.

FIGS. **4***a* and **4***b* show a floor panel according to FIGS. **2***a-c* as seen from below and from above, respectively.

FIG. **5** illustrates in perspective a method for laying and [35] joining floor panels according to a third embodiment of the invention.

FIG. **6** shows in perspective and from below a first variant for mounting a strip on a floor panel.

FIG. **7** shows in section a second variant for mounting a [40] strip on a floor panel.

DESCRIPTION OF PREFERRED EMBODIMENTS

FIGS. **1***a* and **1***b*, to which reference is now made, [45] illustrate a first floor panel **1**, hereinafter termed strip panel, and a second floor panel **2**, hereinafter termed groove panel. The terms "strip panel" and "groove panel" are merely intended to facilitate the description of the invention, the panels **1**, **2** normally being identical in practice. The panels [50] **1** and **2** may be made from compact laminate and may have a thickness of about 3 mm with a thickness tolerance of about ± 0.2 mm. Considering this thickness tolerance, the panels **1** and **2** are illustrated with different thicknesses (FIG. **1***b*), the strip panel 1 having a maximum thickness (3.2 mm)

[55] and the groove panel **2** having a minimum thickness (2.8 mm).

To enable mechanical joining of the panels **1**, **2** at opposing joint edges, generally designated **3** and **4**, respectively, the panels are provided with grooves and strips [60] as described in the following.

Reference is now made primarily to FIGS. **1***a* and **1***b*, and secondly to FIGS. **4***a* and **4***b* showing the basic design of the floor panels from below and from above, respectively. [65]

From the joint edge **3** of the strip panel **1**, i.e. the one long side, projects horizontally a fiat strip **6** mounted at the

[7]

factory on the underside of the strip panel **1** and extending throughout the entire joint edge **3**. The strip **6**, which is made of flexible, resilient sheet aluminium, can be fixed mechanically, by means of glue or in any other suitable way. In FIGS. **1***a* and **1***b*, the strip **6** is glued, while in FIGS. **4***a* [5] and **4***b* it is mounted by means of a mechanical connection, which will be described in more detail hereinbelow.

Other strip materials can be used, such as sheets of other metals, as well as aluminium or plastics sections. Alternatively, the strip **6** may be integrally formed with the [10] strip panel **1**. At any rate, the strip **6** should be integrated with the strip panel **1**, i.e. it should not be mounted on the strip panel **1** in connection with laying. As a non-restrictive example, the strip **5** may have a width of about 30 mm and a thickness of about 0.5 mm. [15]

As appears from FIGS. **4***a* and **4***b*, a similar, although shorter strip **6'** is provided also at one short side **3'** of the strip
panel **1**. The shorter strip **6'** does however not extend throughout the entire short side **3'** but is otherwise identical

with the strip **6** and, therefore, is not described in more detail [20] here.

The edge of the strip 6 facing away from the joint edge **3** is formed with a locking element **8** extended throughout the entire strip **6**. The locking element **8** has a locking surface **10** facing the joint edge **3** and having a height of e.g. 0.5 mm. [25] The locking element **8** is so designed that when the floor is being laid and the strip panel **2** of FIG. **1***a* is pressed with its joint edge **4** against the joint edge **3** of the strip panel **1** and is angled down against the subfloor **12** according to FIG. **1***b*, it enters a locking groove **14** formed in the underside **16** of [30] the groove panel **2** and extending parallel to and spaced from the joint edge **4**. In FIG. **1***b*, the locking element **8** and the locking groove **14** together form a mechanical connection locking the panels **1**, **2** to each other in the direction designated D2. More specifically, the locking surface **10** of [35] the locking element **8** serves as a stop with respect to the surface of the locking groove **14** closest to the joint edge **4**.

When the panels **1** and **2** are joined together, they can however occupy such a relative position in the direction D2 that there is a small play Δ between the locking surface **10** [40] and the locking groove **14**. This mechanical connection in the direction D2 allows mutual displacement of the panels **1**, **2** in the direction of the joint, which considerably facilitates the laying and enables joining together the short sides by snap action. [45]

As appears from FIGS. **4***a* and **4***b*, each panel in the system has a strip **6** at one long side **3** and a locking groove **14** at the other long side **4**, as well as a strip **6'** at one short side **3'** and a locking groove **14'** at the other short side **4'**.

Furthermore, the joint edge **3** of the strip panel **1** has in its [50] underside **18** a recess **20** extending throughout the entire joint edge **3** and forming together with the upper face **22** of the strip **6** a laterally open recess **24**. The joint edge **4** of the groove panel **2** has in its top side **26** a corresponding recess

28 forming a locking tongue **30** to be accommodated in the [55] recess **24** so as to form a mechanical connection locking the joint edges **3**, **4** to each other in the direction designated D1. This connection can be achieved with other designs of the joint edges **3**, **4**, for example by a bevel thereof such that the joint edge **4** of the groove panel **2** passes obliquely in [60] underneath the joint edge **3** of the strip panel **1** to be locked between that edge and the strip **6**.

The panels **1**, **2** can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again. [65]

The strip **6** is mounted in a tolerance equalizing groove **40** in the underside **18** of the strip panel **1** adjacent the joint

[8]

edge **3**. In this embodiment, the width of the equalizing groove **40** is approximately equal to half the width of the strip **6**, i.e. about 15 mm. By means of the equalizing groove **40**, it is ensured that there will always exist between the top side **21** of the panel **1** and the [5] bottom of the groove **40** an exact, predetermined distance E which is slightly smaller than the minimum thickness (2.8 mm) of the floor panels **1**, **2**. The groove panel **2** has a corresponding tolerance-equalizing surface or groove **42** in the underside **16** of the joint edge [10] **4**. The distance between the equalizing surface **42** and the top side **26** of the groove panel **2** is equal to the aforementioned exact distance E. Further, the thickness of the strip **6** is so chosen that the underside **44** of the strip is situated slightly below the undersides **18** and **16** [15] of the floor panels **1** and **2**, respectively. In this manner, the entire joint will rest on the strip **6**, and all vertical downwardly-directed forces will be efficiently transmitted to the subfloor **12** without any stresses being exerted on the joint edges **3**, **4**. Thanks to the provision [20] of the equalizing grooves **40**, **42**, an entirely even joint

will be achieved on the top side, despite the thickness tolerances of the panels **1**, **2**, without having to perform any grinding or the like across the whole panels. Especially, this obviates the risk of damage to the [25] bottom layer of the compact laminate, which might give rise to bulging of the panels.

Reference is now made to the embodiment of FIGS. **2***a-c* showing in a succession substantially the same laying method as in FIGS. **1***a* and **1***b*. The embodiment of FIGS. **2***a-c* primarily differs from the embodiment of FIGS. [30] **1***a* and **1***b* in that the strip **6** is mounted on the strip panel **1** by means of a mechanical connection instead of glue. To provide this mechanical connection, illustrated in more detail in FIG. **6**, a groove **50** is provided in the underside **18** of the strip panel [35] **1** at a distance from the recess **24**. The groove **50** may be formed either as a continuous groove extending throughout the entire length of the panel **1**, or as a number of separate grooves. The groove **50** defines, together with the recess **24**, a dovetail gripping edge **52**, the underside of which exhibits [40] an exact equalizing distance E to the top side **21** of the strip panel **1**. The aluminium strip **6** has a number of punched and bent tongues **54**, as well as one or more lips **56** which are bent round opposite sides of the gripping edge **52** in clamping arrangement therewith. This connection is shown in [45] detail from below in the perspective view of FIG. **6**.

Alternatively, a mechanical connection between the strip **6** and the strip panel **1** can be provided as illustrated in FIG. **7** showing in section a cut-away part of the strip panel **1** turned upside down. In FIG. **7**, the mechanical connection [50] comprises a dovetail recess **58** in the underside **18** of the strip panel **1**, as well as tongues/lips **60** punched and bent from the strip **6** and clamping against opposing inner sides of the recess **58**.

The embodiment of FIGS. **2***a-c* is further characterised in [55] that the locking element **8** of the strip **6** is designed as a

component bent from the aluminium sheet and having an operative locking surface **10** extending at right angles up from the front side **22** of the strip **6** through a height of e.g. 0.5 mm, and a rounded guide surface **34** facilitating the [60] insertion of the locking element **8** into the locking groove **14** when angling down the groove panel **2** towards the subfloor **12** (FIG. 2*b*), as well as a portion **36** which is inclined towards the subfloor **12** and which is not operative in the laying method illustrated in FIGS. 2*a-c*. [65]

Further, it can be seen from FIGS. 2*a-c* that the joint edge **3** of the strip panel **1** has a lower bevel **70** which cooperates

[9]

during laying with a corresponding upper bevel **72** of the joint edge **4** of the groove panel **2**, such that the panels **1** and **2** are forced to move vertically towards each other when their joint edges **3**, **4** are moved up to each other and the panels are pressed together horizontally. [5]

Preferably, the locking surface **10** is so located relative to the joint edge **3** that when the groove panel **2**, starting from the joined position in FIG. 2*c*, is pressed horizontally in the direction D2 against the strip panel **1** and is turned angularly up from the strip **6**, the maximum distance between the axis [10] of rotation A of the groove panel **2** and the locking surface **10** of the locking groove is such that the locking element **8** can leave the locking groove **14** without coming into contact with it.

FIGS. 3*a*-3*b* show another joining method for mechanically [15] joining together the floor panels of FIGS. 2*a-c*. The method illustrated in FIGS. 3*a-c* relies on the fact that the strip **6** is resilient and is especially useful for joining together the short sides of floor panels which have already been joined along one long side as illustrated in FIGS. 2*a-c*. The [20] method of FIGS. 3*a-c* is performed by first placing

the two panels **1** and **2** flat on the subfloor **12** and then moving them horizontally towards each other according to FIG. 3*b*. The inclined portion **35** of the locking element **8** then serves as a guide surface which guides the joint edge **4** of the groove [25] panel **2** up on to the upper side **22** of the strip **6**. The strip **6** will then be urged downwards while the locking element **8** is sliding on the equalizing surface **42**. When the joint edges **3**, **4** have been brought into complete engagement with each other horizontally, the locking element **8** will snap [30] into the locking groove **14** (FIG. 3*c*), thereby providing the same locking as in FIG. 2*c*. The same locking method can also be used by placing, in the initial position, the joint edge **4** of the groove panel with the equalizing groove **42** on the locking element **10** (FIG. 3*a*). The inclined portion **36** of the [35] locking element **10** then is not operative. This technique thus makes it possible to lock the floor panels mechanically in all directions, and by repeating the laying operations the whole floor can be laid without using any glue.

The invention is not restricted to the preferred embodiments [40] described above and illustrated in the drawings, but several variants and modifications thereof are conceivable within the scope of the appended claims. The strip **6** can be divided into small sections covering the major part of the joint length. Further, the thickness of the strip **6** may vary [45] throughout its width. All strips, locking grooves, locking elements and recesses are so dimensioned as to enable laying the floor panels with flat top sides in a manner to rests on the strip **6** in the joint. If the floor panels consist of compact laminate and if silicone or any other sealing [50] compound, a rubber strip or any other sealing device is applied prior to laying between the flat projecting part of the strip **6** and the groove panel **2** and or in the recess **26**, a moisture-proof floor is obtained.

As appears from FIG. **6**, an underlay **46**, e.g. of floor [55] board, foam or felt, can be mounted on the underside of the

panels during the manufacture thereof. In one embodiment, the underlay **46** covers the strip **6** up to the locking element **8**, such that the joint between the underlays 46 becomes offset in relation to the joint between the joint edges **3** and [60] **4**.

In the embodiment of FIG. **5**, the strip **6** and its locking element **8** are integrally formed with the strip panel **1**, the projecting part of the strip **6** thus forming an extension of the lower part of the joint edge **3**. The locking function is the [65] same as in the embodiments described above. On the underside **18** of the strip panel **1**, there is provided a separate strip,

[10]

band or the like **74** extending throughout the entire length of the joint and having, in this embodiment, a width covering approximately the same surface as the separate strip **6** of the previous embodiments. The strip **74** can be provided directly on the rear side **18** or in a recess formed therein (not shown), [5] so that the distance from the front side **21**, **26** of the floor to the rear side **76**, including the thickness of the strip **74**, always is at least equal to the corresponding distance in the panel having the greatest thickness tolerance. The panels **1**, **2** will then rest, in the joint, on the strip **74** or only on the [10] undersides **18**, **16** of the panels, if these sides are made plane.

When using a material which does not permit downward bending of the strip **6** or the locking element **8**, laying can be performed in the way shown in FIG. **5**. A floor panel **2*a*** [15] is moved angled upwardly with its long side **4*a*** into engagement with the long side **3** of a previously laid floor panel **1** while at the same time a third floor panel **2*b*** is moved with its short side **4*b***' into engagement with the short side **3*a***' of the upwardly-angled floor panel **2*a*** and is fastened by [20] angling the panel **2*b*** downwards. The panel **2*b*** is then pushed along the short side **3*a***' of the upwardly-angled floor panel **2*a***

until its long side **4***b* encounters the long side **3** of the initially-laid panel **1**. The two upwardly-angled panels **2***a* and **2***b* are therefore angled down on the subfloor **12** so [25] as to bring about locking.

By a reverse procedure the panels can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again.

Several variants of preferred laying methods are conceivable. [30] For example, the strip panel can be inserted under the groove panel, thus enabling the laying of panels in all four directions with respect to the initial position.

I claim:

1. A method of laying and mechanically joining floor [35] panels in parallel rows, wherein relative positions of the panels during the method can be defined as including first and second mutual positions, a first mutual position in which (i) the two panels are held in an angled position relative to each other and (ii) upper portions of adjacent edges of the [40] two panels are in mutual contact, and a second mutual position in which the two panels are (i) located in a common plane, (ii) mechanically locked to each other in a first direction that is at right angles to the common plane, (iii) mechanically locked to each other in a second direction, that [45] is at right angles to said first direction and to the adjacent joint edges, as a result of a first locking member disposed at one of the adjacent edges being connected to a second locking member disposed at the other one of the adjacent edges, and (iv) being displaceable in relation to each other [50] in the direction of the adjacent joint edges, wherein said method comprises the steps of:

(a) bringing a new one of the panels into an intermediary position where (i) a previously laid first one of the panels is located in a first row, (ii) a second one of the [55] panels is located in a second row and is in said first mutual position in relation to the first

panel, and (iii) the new panel is located in the second row and is in said second mutual position in relation to the second panel and is in a position relative to the first panel such that [60] a mutual distance is present between the upper portions of the adjacent joint edges of the new panel and the first panel;

(b) while maintaining said second mutual position between the new panel and the second panel, displacing [65] the new panel relative to the second panel into said first mutual position in relation to the first panel; and

[11]

(c) angling the new panel and the second panel together into said second mutual position in relation to the first panel.

2. The method according to claim **1**, wherein the first locking member is a locking groove and the second locking [5] member is a locking element which is received in the locking groove.

3. The method according to claim **1**, wherein said step of bringing the new panel into the intermediary position comprises the step of bringing the new panel and the second [10] panel into said first mutual position in relation to each other and then angling the new panel into said second mutual position in relation to the second panel.

4. The method according to claim **3**, wherein the first locking member is a locking element which is received in [15] the second locking member which is a locking groove.

5. A method of producing a floor by laying and mechanically joining floor panels in parallel rows, wherein said method comprises the steps of:

(a) providing floor panels wherein relative positions of the [20] panels during the method can be defined to

include first and second mutual positions, a first mutual position in which (i) two adjacent panels are held in an angled position relative to each other and (ii) upper portions of adjacent edges of the two panels are in mutual contact, [25] and a second mutual position in two adjacent panels are (i) located in a common plane, (ii) mechanically locked to each other in a first direction that is at right angles to the common plane, (iii) mechanically locked to each other in a second direction, that is at right angles to said [30] first direction and to the adjacent joint edges, as a result of a first locking member disposed at one of the adjacent edges being connected to a second locking member disposed at the other one of the adjacent edges, and (iv) being displaceable in relation to each other in [35] the direction of the adjacent joint edges,

(b) bringing a new one of the panels into an intermediary position where (i) a previously laid first one of the panels is located in a first row, (ii) a second one of the panels is located in a second row and is in said first [40] mutual position in relation to the first panel, and (iii) the new panel is located in the second row and is in said second mutual position in relation to the second panel and is in a position relative to the first panel such that a mutual distance is present between the upper portions [45] of the adjacent joint edges of the new panel and the first panel;

(c) while maintaining said second mutual position between the new panel and the second panel, displacing the new panel relative to the second panel into said first [50] mutual position in relation to the first panel; and

(d) angling the new panel and the second panel together into said second mutual position in relation to the first panel.

6. The method according to claim **5**, wherein the first [55] locking member is a locking groove and the second locking member is a locking element which is received in the locking groove.

7. The method according to claim **5**, wherein said step of bringing the new panel into the intermediary position comprises [60] the step of bringing the new panel and the second panel into said first mutual position in relation to each other and then angling the new panel into said second mutual position in relation to the second panel.

8. The method according to claim **7**, wherein the first [65] locking member is a locking element which is received in the second locking member which is a locking groove.

[12]

9. A method of laying and mechanically joining rectangular floor panels in parallel rows, the method comprising the steps of:

(a) placing a new one of the panels adjacent to one edge of a previously laid first one of the panels in a first row [5] and adjacent to another edge of a previously laid second one of the panels in an adjacent second row, such that the new panel is spaced from a final position relative to both the first and second panels;

(b) displacing the new panel towards the first panel such [10] that a locking element of a resilient locking strip disposed at one of the new panel and the first panel snaps up into a locking groove disposed at the other one of the new panel and the first panel and to thereby mechanically lock together the new and first panels in [15] a first direction that is at right angle to a principal plane of the first panel and in a second direction that is at right angles to the first direction

and to the thus connected set of edges of the new panel and the first panel; and

(c) displacing the new panel relative to the first panel in [20] a direction parallel with said connected set of edges, while maintaining the new and first panels locked together in said first and second directions, towards a final position until a locking element of a resilient locking strip disposed at one of an another edge of the [25] new panel and said another edge of the second panel snaps up into a locking groove disposed at the one of the another edges, whereby the new panel and the second panel are mechanically locked to each other in both the first direction and the second direction with [30] respect to the thus connected set of another edges.

10. A method as claimed in claim 9, wherein the new panel is placed in the same first row as the first panel.

11. A method as claimed in claim 9, wherein the new panel is placed in the same second row as the second panel. [35]

12. A method of laying and mechanically joining floor panels in parallel rows, wherein each two adjacent panels of the panels are arranged to be brought into a mechanically locked mutual position by placing the panels at a mutual distance in a common plane and displacing one of the panels [40] into engagement with the other one in a direction that is at right angles to adjacent edges of the two panels, in which mechanically locked mutual position the two panels are (i) located in the common plane, (ii) mechanically locked to each other in a first direction that is at right angles to the [45] common plane, (iii) mechanically locked to each other in a second direction, that is at right angles to said first direction and to the adjacent joint edges, as a result of a first locking member disposed at one of the adjacent edges being connected to a second locking member disposed at the other one [50] of

the adjacent edges, and (iv) being displaceable in relation to each other in the direction of the adjacent joint edges, wherein said method comprises the steps of:

(a) placing a new one of the panels adjacent to a previously laid first one of the panels in a first row and [55] adjacent to a previously laid second one of the panels in an adjacent second row, such that the new panel is spaced from a final position relative to both the first and second panels;

(b) displacing the new panel towards the first panel until [60] the new panel and the first panel have been brought into said locked position; and

(c) displacing the new panel relative to the first panel and towards the second panel while maintaining the new panel and the first panel in the locked mutual position. [65]

13. A method for disassembling floor panels which have been mechanically joined in parallel rows, wherein two

[13]

adjacent panels of the panels are arranged to occupy first and second mutual positions, a first mutual position in which (i) the two panels are held in an angled position relative to each other and (ii) upper portions of adjacent edges of the two panels are in mutual contact, and a second mutual [5] position in which the two panels are (i) located in a common plane, (ii) mechanically locked to each other in a first direction that is at right angles to the common plane, (iii) mechanically locked to each other in a second direction, that is at right angles to said first direction and to the adjacent joint edges, [10] as a result of a first locking member disposed at one of the adjacent edges being connected to a second locking member disposed at the other one of the adjacent edges, and (iv) being displaceable in relation to each other in the direction of the

adjacent joint edges, wherein said method comprises [15] the following steps for taking up a given panel located in a given row, said given panel being in said second mutual position in relation to an adjacent first panel in an adjacent row and also in said second mutual position in relation to an adjacent second panel in the given row;

[14]

(a) angling the given panel and the second panel together into said first mutual position in relation to the first panel; and then

(b) while maintaining said second mutual position between the given panel and the second panel, displacing [5] the given panel relative to the second panel in a direction away from the first panel.

14. A method as claimed in claim **13**, wherein said step of displacing the given panel relative to the second panel in a [10] direction away from the first panel is performed to such an extent that the given panel and the second panel are still in said second mutual position at the end of said step of displacing, said method further comprising the subsequent the step of angling the given panel in relation to the second [15] panel in order to release the given panel from the second panel.

* * * * *

APPENDIX F

UNITED STATES PATENT

Patent No. 5,860,267

See Fold Out Exhibit
Diagrams

US005860267A

United States Patent [19]

Pervan

[11] Patent Number: 5,860,267

[45] Date of Patent: Jan. 19, 1999

[54] **METHOD FOR JOINING BUILDING BOARDS**

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[52] **U.S. Cl.** **52/748.1**; 52/747.1; 52/747.11; 52/403.1; 52/480; 52/506.05; 52/551; 52/582.1; 52/592.2

[58] **Field of Search** 52/745.05, 745.21, 52/747.1, 747.11, 748.1, 403.1, 480, 506.05, 551, 582.1, 591.3, 592.2

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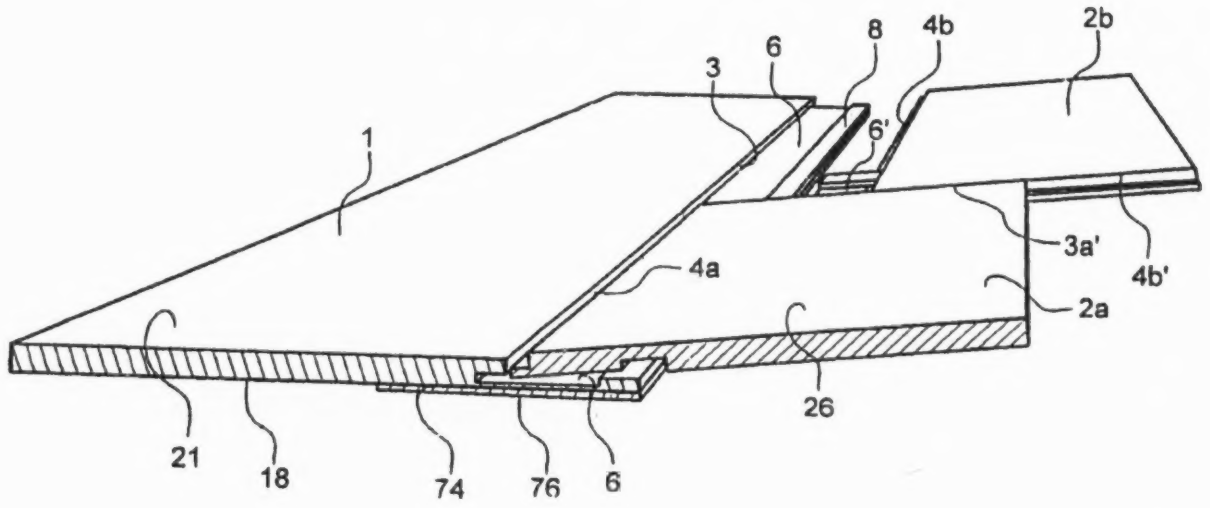
[57] **ABSTRACT**

A method for laying and mechanically joining rectangular building panels in parallel rows includes the steps of (a) placing a new one of the panels adjacent to a long edge of a previously laid first one of the panels in a first row and to a short edge of a previously laid second one of the panels in an adjacent second row, such that the new one of the panels is in the second row, while holding the new one of the panels at an angle relative to a principal plane of the first panel, such that the new one of the panels is spaced from its final longitudinal position relative to said second panel and such that the long edge of the new panel is provided with a locking groove which is placed upon and in contact with a locking strip at the adjacent long edge of the first panel; (b) subsequently angling down the new one of the panels so as to accommodate a locking element of the strip of the first panel in the locking groove of the new panel, whereby the new panel and the first panel are mechanically connected with each other in a second direction with respect to the thus connected long edges, wherein the long edges, in the angled down position of the new panel, are in engagement with each other and thereby mechanically locked together in a first direction also; and (c) displacing the new one of the panels in its longitudinal direction relative to the first panel towards a final longitudinal position until a locking element of one of the short edges of the new one of the panels and the second panel snaps up into a locking groove of the other one of the short edges, whereby the new one of the panels and the second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus connected short edges.

42 Claims, 6 Drawing Sheets



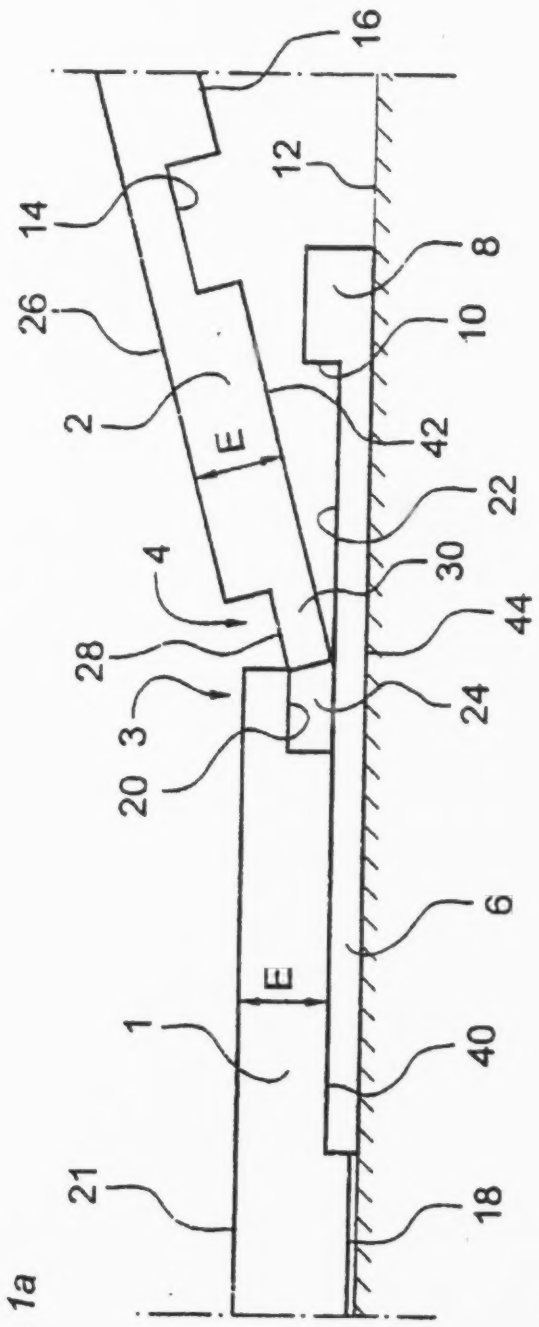

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Fig. 1a

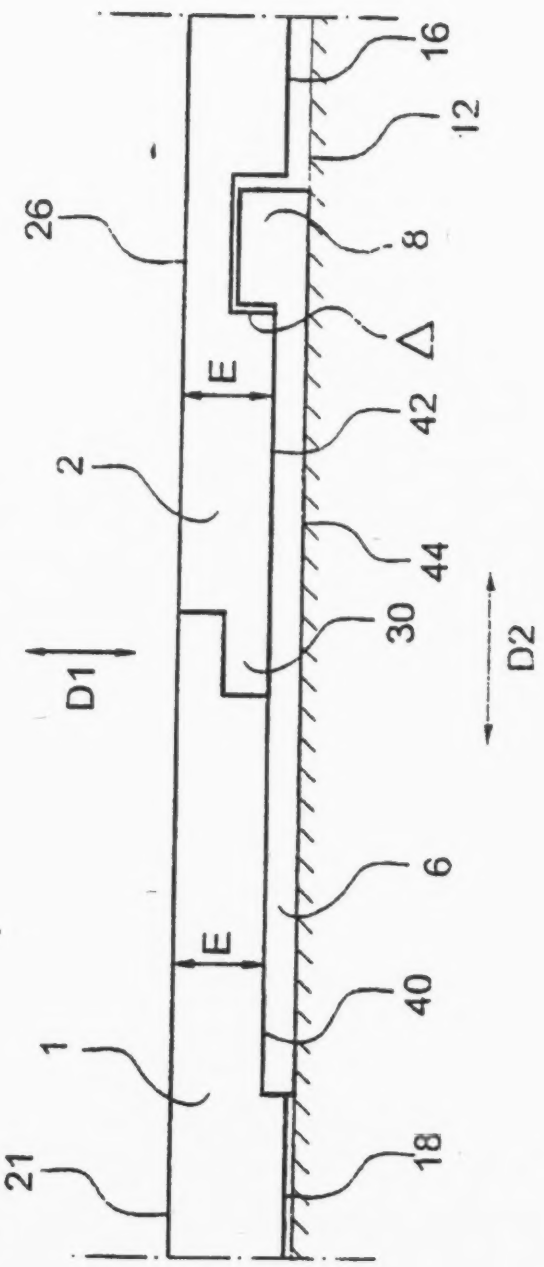
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Fig. 1b

Fig. 2a

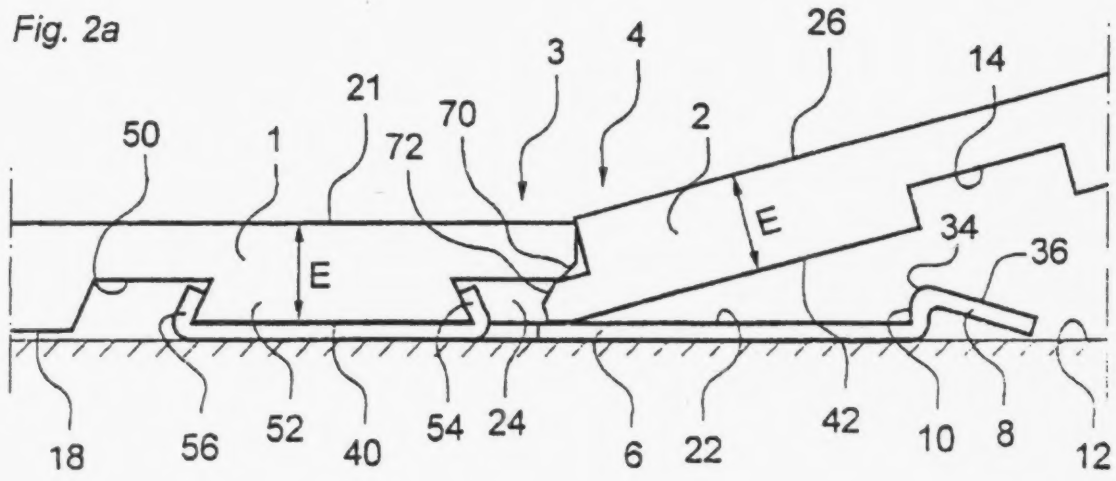


Fig. 2b

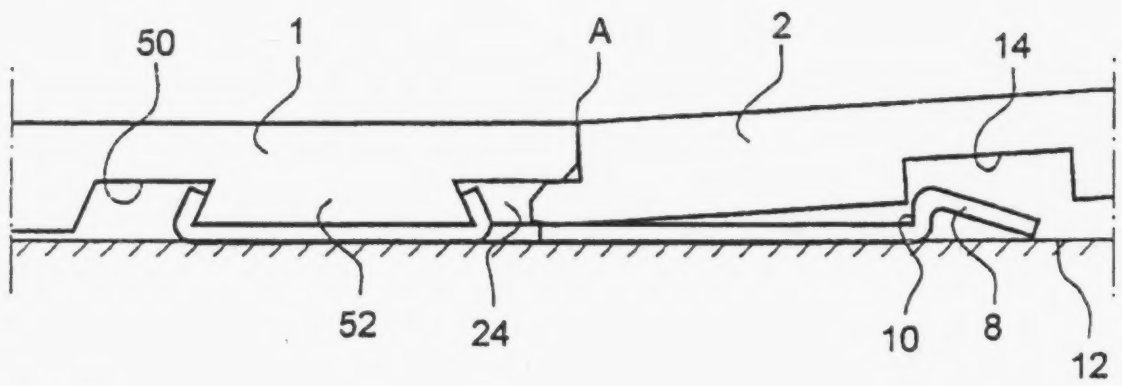


Fig. 2c

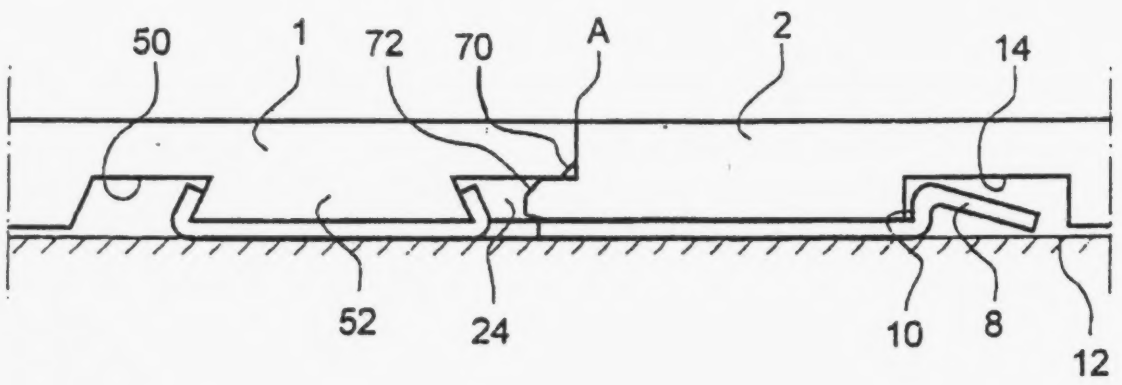


Fig. 3a

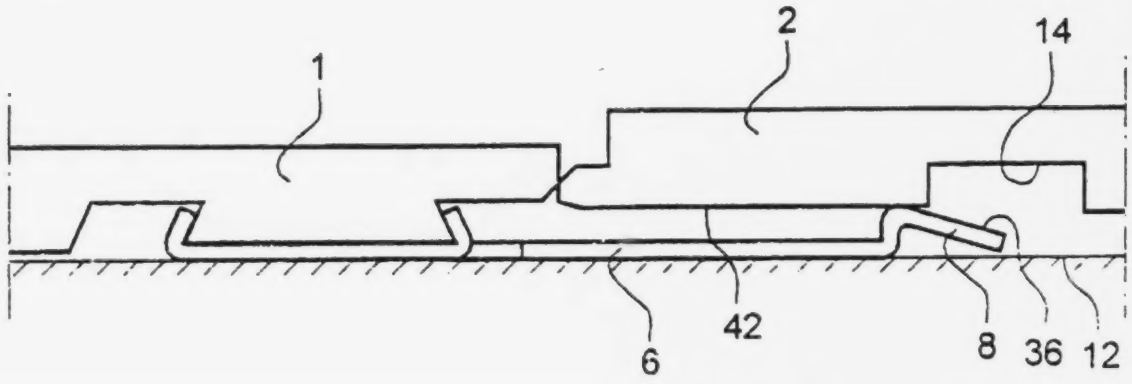


Fig. 3b

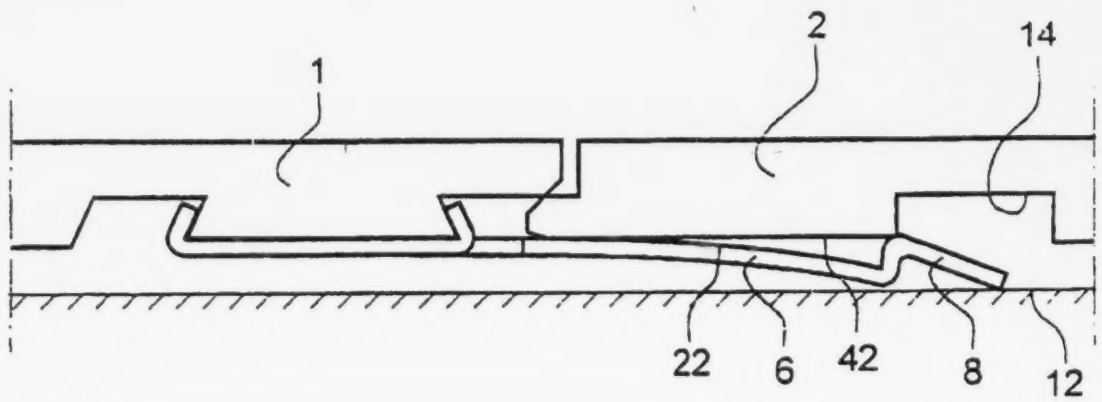


Fig. 3c

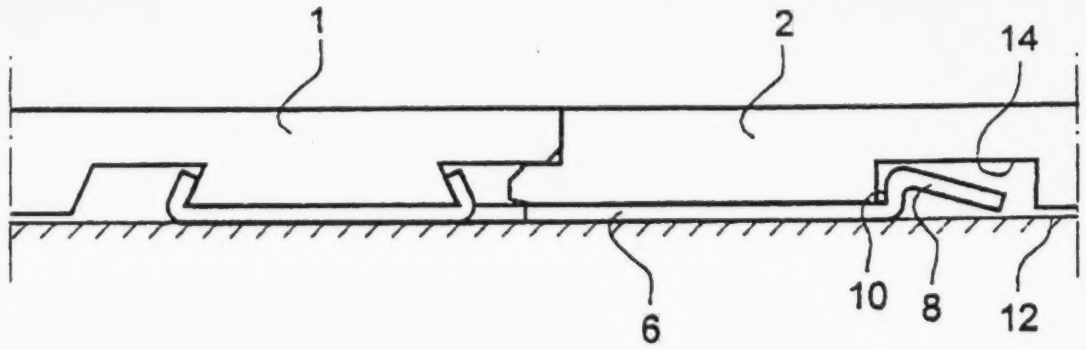


Fig. 4a

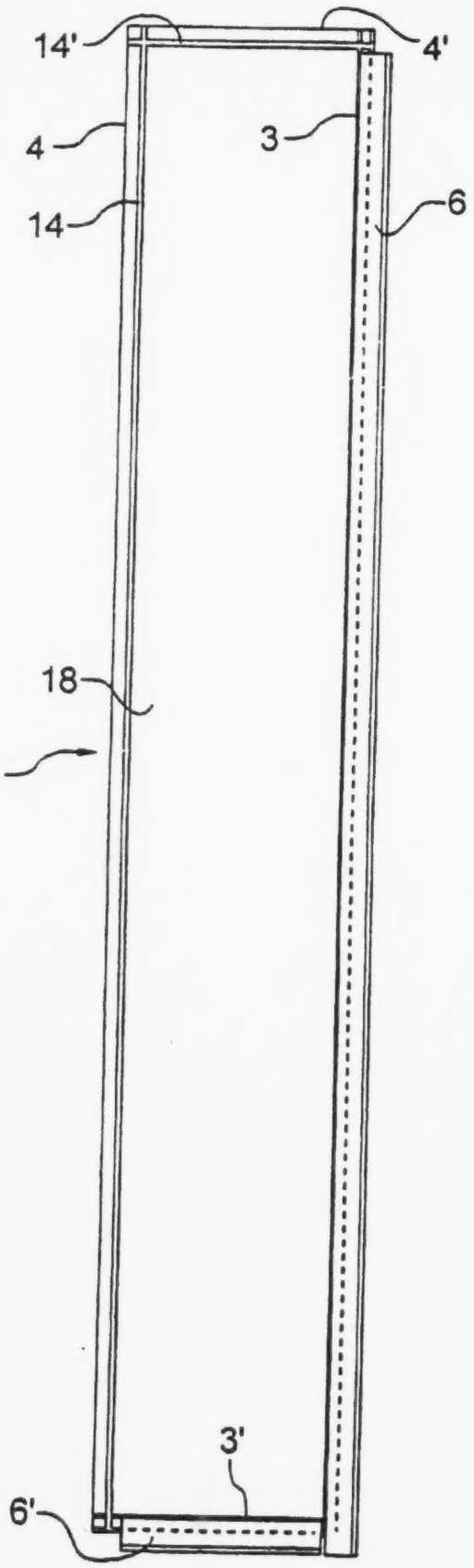
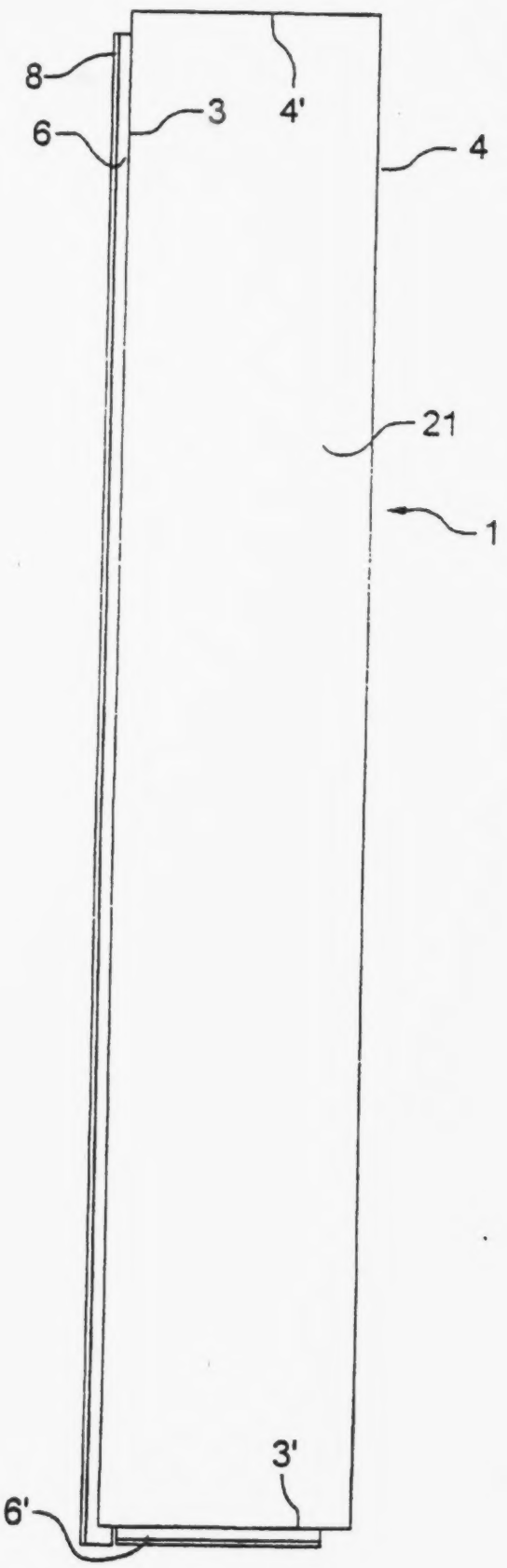


Fig. 4b



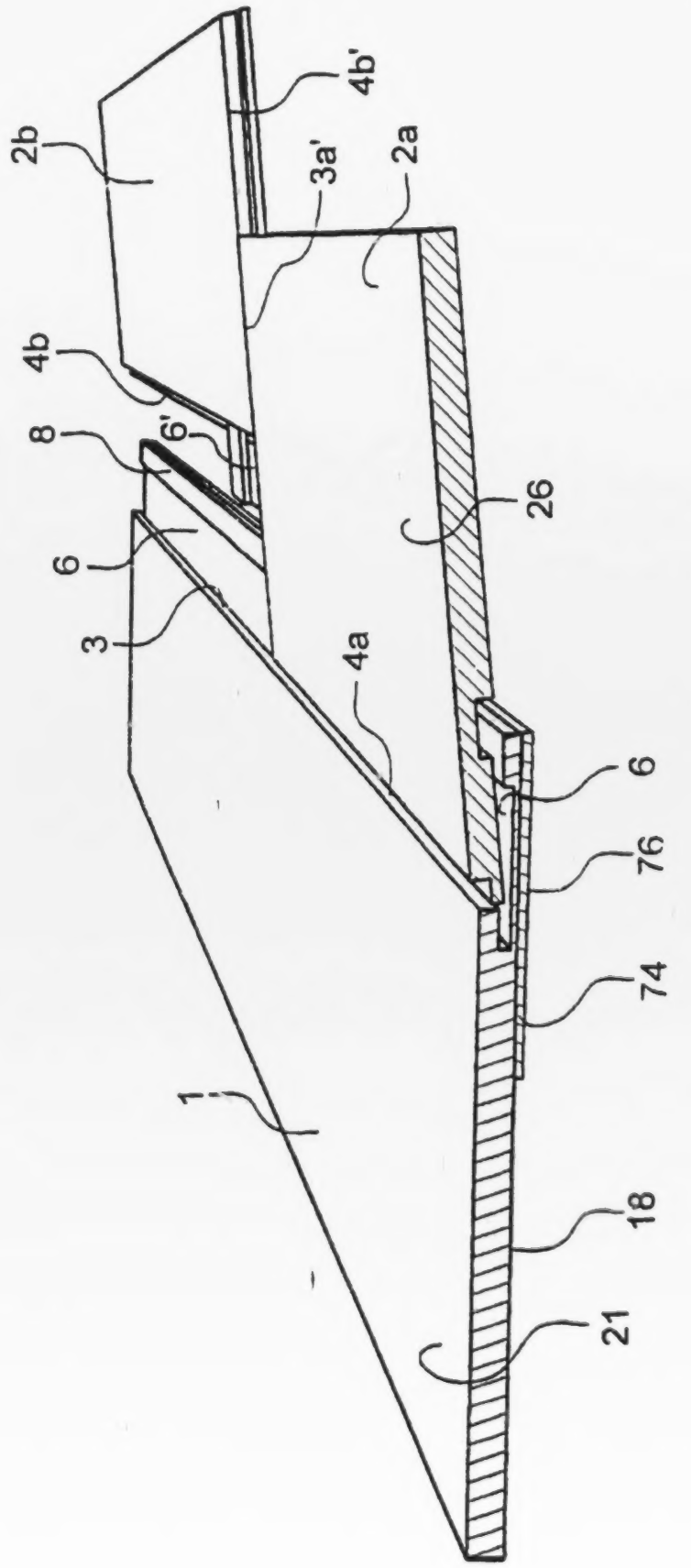


Fig. 5

Fig. 6

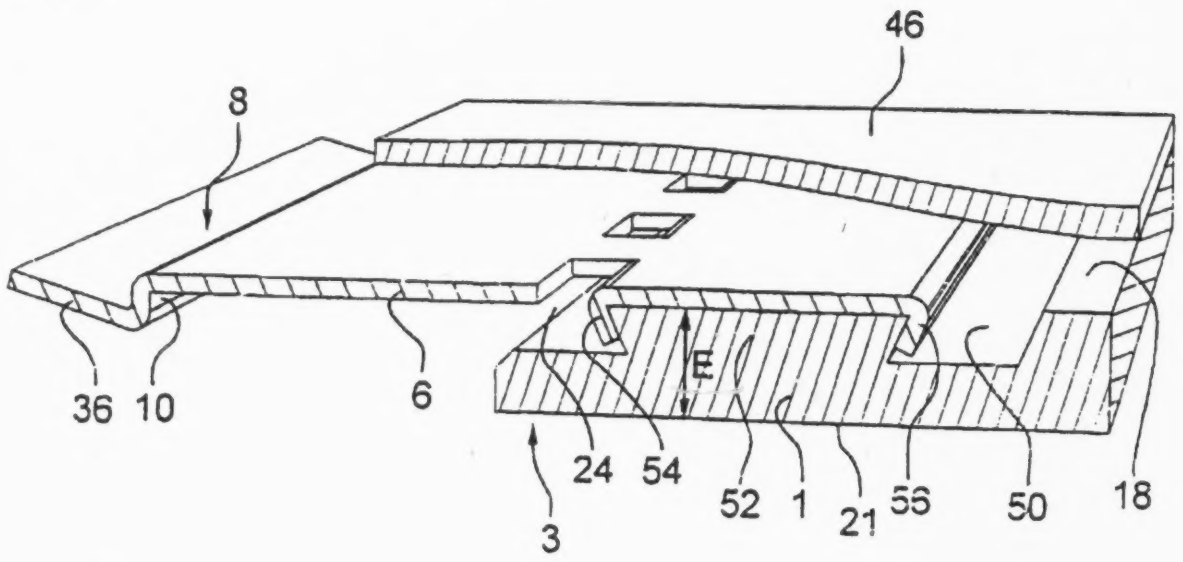
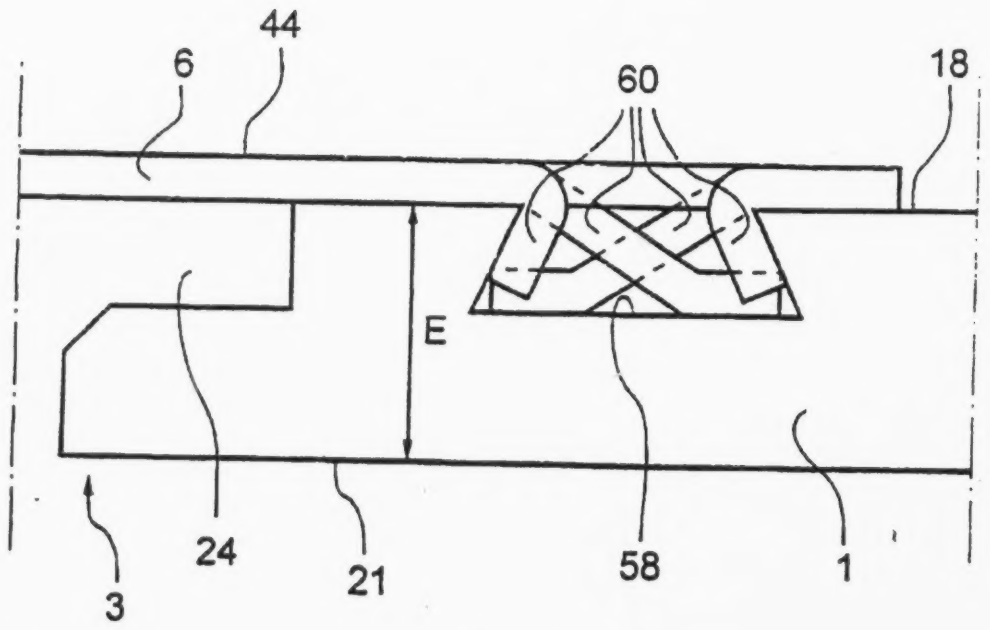


Fig. 7



5,860,267

[1]

METHOD FOR JOINING BUILDING BOARDS

This application is a divisional, of application Ser. No. 08/436,224, filed May 17, 1995, now U.S. Pat. No. 5,706,621. [5]

TECHNICAL FIELD

The invention generally relates to a system for providing a joint along adjacent joint edges of two building panels, [10] especially floor panels.

More specifically, the joint is of the type where the adjacent joint edges together form a first mechanical connection locking the joint edges to each other in a first direction at right angles to the principal plane of the panels, [15] and where a locking device forms a second mechanical connection locking the panels to each other in a second direction parallel to the principal plane and at right angles to the joint edges, the locking device comprising a locking groove which extends parallel to and spaced from the joint [20] edge of one of the panels, and said locking groove being open at the rear side of this one panel.

The invention is especially well, suited for use in joining floor panels, especially thin laminated floors. Thus, the following description of the prior art and of the objects and [25] features of the invention will be focused on this field of use. It should however be emphasised that the invention is useful also for joining ordinary wooden floors as well as other types of building panels, such as wall panels and roof slabs. [30]

BACKGROUND OF THE INVENTION

A joint of the aforementioned type is known, e.g. from SE 450,141. The first mechanical connection is achieved by means of joint edges having tongues and grooves. [35] The locking device for the second mechanical connection comprises two oblique locking grooves, one in the rear side of each panel, and a plurality of spaced-apart spring clips which are distributed along the joint and the legs of which are pressed into the grooves, and which are biased so as to [40] tightly clamp the floor panels together. Such a joining technique is especially useful for joining thick floor panels to form surfaces of a considerable expanse.

Thin floor panels of a thickness of about 7-10 mm, especially laminated floors, have in a short time taken a [45] substantial share of the market. All thin floor panels employed are laid as "floating floors" without being attached to the supporting structure. As a rule, the dimension of the floor panels is 200×1200 mm, and their long and short sides are formed with tongues and grooves. Traditionally, the floor [50] is assembled by applying glue in the groove and forcing the floor panels together. The tongue is then glued in the groove of the other panel. As a rule, a laminated floor consists of an upper decorative wear layer of laminate having a thickness of about 1 mm, an intermediate core of laminate board Cr [55] other board, and a base layer to balance the construction. The core has essentially poorer properties than the laminate, e.g. in respect of hardness and water resistance, but it is nonetheless needed primarily for providing a groove and tongue for assemblage. This means that the overall thickness [60] must be at least about 7 mm. These known laminated floors using glued tongue-and-groove joints however suffer from several inconveniences.

First, the requirement of an overall thickness of at least about 7 mm entails an undesirable restraint in connection [65]

with the laying of the floor, since it is easier to cope with low thresholds when using thin floor panels, and doors must

[2]

often be adjusted in height to come clear of the floor laid. Moreover, manufacturing costs are directly linked with the consumption of material.

Second, the core must be made of moisture-absorbent material to permit using water-based glues when laying the [5] floor. Therefore, it is not possible to make the floors thinner using so-called compact laminate, because of the absence of suitable gluing methods for such non-moisture-absorbent core materials.

Third, since the laminate layer of the laminated floors is [10] highly wear-resistant, tool wear is a major problem when working the surface in connection with the formation of the tongue.

Fourth, the strength of the joint, based on a glued tongue-and-groove connection, is restricted by the properties of the [15] core and of the glue as well as by the depth and height of the groove. The laying quality is entirely dependent on the gluing. In the event of poor gluing, the joint will open as a result of the tensile stresses which occur e.g. in connection with a change in air humidity. [20]

Fifth, laying a floor with glued tongue-and-groove joints is time-consuming, in that glue must be applied to every panel on both the long and short sides thereof.

Sixth, it is not possible to disassemble a glued floor once laid, without having to break up the joints. Floor panels that [25] have been taken up cannot therefore be used again. This is a drawback particularly in rental houses where the flat concerned must be put back into the initial state of occupancy. Nor can damaged or worn-out panels be replaced without extensive efforts, which would be particularly desirable [30]

on public premises and other areas where parts of the floor are subjected to great wear.

Seventh, known laminated floors are not suited for such use as involves a considerable risk of moisture penetrating down into the moisture-sensitive core. [35]

Eighth, present-day hard, floating floors require, prior to laying the floor panels on hard subfloors, the laying of a separate underlay of floor board, felt, foam or the like, which is to damp impact sounds and to make the floor more pleasant to walk on. The placement of the underlay is [40] complicated operation, since the underlay must be placed in edge-to-edge fashion. Different under-lays affect the properties of the floor.

There is thus a strongly-felt need to overcome the above-mentioned drawbacks of the prior art. It is however not [45] possible simply to use the known joining technique with glued tongues and grooves for very thin floors, e.g. with floor thicknesses of about 3 mm, since a joint based on a tongue-and-groove connection would not be sufficiently strong and practically impossible to produce for such thin [50] floors. Nor are any other known joining techniques usable for such thin floors. Another reason why the making of thin floors from e.g. compact laminate involves problems is the thickness tolerances of the panels, being about 0.2-0.3 mm for a panel thickness or about 3 mm. A 3-mm compact [55] laminate panel having such a thickness tolerance would have, if ground to uniform thickness on its rear side, an unsymmetrical design, entailing the risk of bulging. Moreover, if the panels have different thicknesses, this also means that the joint will be subjected to excessive load. [60]

Nor is it possible to overcome the above-mentioned problems by using double-adhesive tape or the like on the undersides of the panels, since such a connection catches directly and does not allow for subsequent adjustment of the panels as is the case with ordinary gluing. [65]

Using U-shaped clips of the type disclosed in the above-mentioned SE 450,141, or similar techniques, to overcome

[3]

the drawbacks discussed above is no viable alternative either. Especially biased clips of this type cannot be used for joining panels of such a small thickness as 3 mm. Normally, it is not possible to disassemble the floor panels without having access to their undersides. This known technology [5] relying on clips suffers from the additional drawbacks:

Subsequent adjustment of the panels in their longitudinal direction is a complicated operation in connection with laying, since the clips urge the panels tightly against each other. [10]

Floor laying using clips is time-consuming.

This technique is usable only in those cases where the floor panels are resting on underlying joists with the clips placed therebetween. For thin floors to be laid on [15] a continuous, flat supporting structure, such clips cannot be used.

The floor panels can be joined together only at their long sides. No clip connection is provided on the short sides. [20]

TECHNICAL PROBLEMS AND OBJECTS OF THE INVENTION

A main object of the invention therefore is to provide a system for joining together building panels, especially floor panels for hard, floating floors, which allows using floor [25] panels of a smaller overall thickness than present-day floor panels.

A particular object of the invention is to provide a panel-joining system which [30]

makes it possible in a simple, cheap and rational way to provide a joint between floor panels without requiring the use of glue, especially a joint based primarily only on mechanical connections between the panels;

can be used for joining floor panels which have a smaller [35] thickness than present-day laminated floors and which have, because of the use of a different core material, superior properties than present-day floors even at a thickness of 3 mm;

makes it possible between thin floor panels to provide a [40] joint that eliminates any unevennesses in the joint because of thickness tolerances of the panels;

allows joining all the edges of the panels;

reduces tool wear when manufacturing floor panels with hard surface layers; [45]

allows repeated disassembly and reassembly of a floor previously laid, without causing damage to the panels, while ensuring high laying quality;

makes it possible to provide moisture-proof floors; [50]

makes it possible to obviate the need of accurate, separate placement of an underlay before laying the floor panels; and

considerably cuts the time for joining the panels.

These and other objects of the invention are achieved by [55] means of a panel-joining system having the features recited in the appended claims.

Thus, the invention provides a system for making a joint along adjacent joint edges of two building panels, especially floor panels, in which joint: [60]

the adjacent joint edges together form a first mechanical connection locking the joint edges to each

other in a first direction at right angles to the principal plane of the panels, and

a locking device arranged on the rear side of the panels [65] forms a second mechanical connection locking the panels to each other in a second direction parallel to the

[4]

principal plane and at right angles to the joint edges, said locking device comprising a locking groove which extends parallel to and spaced from the joint edge of one of said panels, termed groove panel, and which is open at the rear side of the groove panel, said system [5] being characterised in

that the locking device further comprises a strip integrated with the other of said panels, termed strip panel, said strip extending throughout substantially the entire length of the joint edge of the strip panel and being [10] provided with a locking element projecting from the strip, such that when the panels are joined together, the strip projects on the rear side of the groove panel with its locking element received the locking groove of the groove panel, [15]

that the panels, when joined together, can occupy a relative position in said second direction where a play exists between the locking groove and a locking surface on the locking element that is facing the joint edges and is operative in said second mechanical connection, [20]

that the first and the second mechanical connection both allow mutual displacement of the panels in the direction of the joint edges, and

that the second mechanical connection is so conceived as to allow the locking element to leave the

locking [25] groove if the groove panel is turned about its joint edge angularly away from the strip.

The term "rear side" as used above should be considered to comprise any side of the panel located behind/underneath the front side of the panel. The opening plane of the locking [30] groove of the groove panel can thus be located at a distance from the rear surface of the panel resting on the supporting structure. Moreover, the strip, which in the invention extends throughout substantially the entire length of the joint edge of the strip panel, should be considered to encompass [35] both the case where the strip is a continuous, uninterrupted element, and the case where the "strip" consists in its longitudinal direction of several parts, together covering the main portion of the joint edge.

It should also be noted (i) that it is the first the second [40] mechanical connection as such that permit mutual displacement of the panels in the direction of the joint edges, and that (ii) it is the second mechanical connection as such that permits the locking element to leave the locking groove if the groove panel is turned about its joint edge angularly [45] away from the strip. Within the scope of the invention, there may thus exist means, such as glue and mechanical devices, that can counteract or prevent such displacement and/or upward angling.

The system according to the invention makes it possible [50] to provide concealed, precise locking of both the short and long sides of the panels in hard, thin floors. The floor panels can be quickly and conveniently disassembled in the reverse order of laying without any risk of damage to the panels, ensuring at the same time a high laying quality. The panels [55] can be assembled and disassembled much faster than in present-day systems, and any damaged or worn-out panels can be replaced by taking up and re-laying parts of the floor.

According to an especially preferred embodiment of the invention, a system is provided which permits precise joining [60] of thin floor panels having, for example, a thickness of the order of 3 mm and which at the same time provides a tolerance-independent smooth top face at the joint. To this end, the strip is mounted in an equalising groove which is countersunk in the rear side of the strip panel and which [65] exhibits an exact, predetermined distance from its bottom to the front side of the strip panel. The part of the strip

[5]

projecting behind the groove panel engages a corresponding equalising groove, which is countersunk in the of the groove panel and which exhibits the same exact, predetermined distance from its bottom to the front side of the groove panel. The thickness of the strip is at least so great that the rear side [5] of the strip is flush with, and preferably projects slightly below the rear side of the panels. In this embodiment, the panels will always rest, in the joint, with their equalising grooves on a strip. This levels out the tolerance and imparts the necessary strength to the joint. The strip transmits [10] horizontal and upwardly-directed forces to the panels and downwardly-directed forces to the existing subfloor.

Preferably, the strip may consist of a material which is flexible, resilient and strong, and can be sawn. A preferred strip material is sheet aluminum. In an aluminum strip, [15] sufficient strength can be achieved with a strip thickness of the order of 0.5 mm.

In order to permit taking up previously laid, joined floor panels in a simple way, a preferred embodiment of the invention is characterised in that when the groove panel is [20] pressed against the strip panel in the second direction and is turned angularly away from the strip, the maximum distance between the axis of rotation of the groove panel and

the locking surface of the locking groove closest to the joint edges is such that the locking element can leave the locking [25] groove without contacting the locking surface of the locking groove. Such a disassembly can be achieved even if the aforementioned play between the locking groove and the locking surface is not greater than 0.2 mm.

According to the invention, the locking surface of the [30] locking element is able to provide a sufficient locking function even with very small heights of the locking surface. Efficient locking of 3-mm floor panels can be achieved with a locking surface that is as low as 2 mm. Even a 0.5-mm-high locking surface may provide sufficient locking. The [35] term "locking surface" as used herein relates to the part of the locking element engaging the locking groove to form the second mechanical connection.

For optimal function of the invention, the strip and the locking element should be formed on the strip panel with [40] high precision. Especially, the locking surface of the locking element should be located at an exact distance from the joint edge of the strip panel.

Furthermore, the extent of the engagement in the floor panels should be minimised, since it reduces the floor [45] strength.

By known manufacturing methods, it is possible to produce a strip with a locking pin, for example by extruding aluminum or plastics into a suitable section, which is thereafter glued to the floor panel or is inserted in special grooves. [50] These and all other traditional methods do however not ensure optimum function and an optimum level of economy. To produce the joint system according to the invention, the strip is suitably formed from sheet aluminum, and is mechanically fixed to the strip panel. [55]

The laying of the panels can be performed by first placing the strip panel on the subfloor and then moving the groove panel with its long side up to the long side of the strip panel,

at an angle between the principal plane of the groove panel and the subfloor. When the joint edges have been brought [60] into engagement with each other to form the first mechanical connection, the groove panel is angled down so as to accommodate the locking element in the locking groove.

Laying can also be performed by first, placing both the strip panel and the groove panel flat on the subfloor and then [65] joining the panels parallel to their principal planes while bending the strip downwards until the locking element snaps

[6]

up into the locking groove. This laying technique enables in particular mechanical locking of both the short and long sides of the floor panels. For example, the long sides can be joined together by using the first laying technique with downward angling of the groove panel, while the short sides [5] are subsequently joined together by displacing the groove panel in its longitudinal direction until its short side is pressed on and locked to the short side of an adjacent panel in the same row.

In connection with their manufacture, the floor panels can [10] be provided with an underlay of e.g. floor board, foam or felt. The underlay should preferably cover the strip such that the joint between the underlays is offset in relation to the joint between the floor panels.

The above and other features and advantages of the [15] invention will appear from the appended claims and the following description of embodiments of the invention.

The invention will now be described in more detail hereinbelow with reference to the accompanying drawing Figures. [20]

DESCRIPTION OF DRAWING FIGURES

FIGS. 1*a* and 1*b* schematically show in two stages how two floor panels of different thickness are joined together in floating fashion according to a first embodiment of the [25] invention.

FIGS. 2*a-c* show in three stages a method for mechanically joining two floor panels according to a second embodiment of the invention.

FIGS. 3*a-c* show in three stages another method for [30] mechanically joining the floor panels of FIGS. 2*a-c*.

FIGS. 4*a* and 4*b* show a floor panel according to FIGS. 2*a-c* as seen from below and from above, respectively.

FIG. 5 illustrates in perspective a method for laying and [35] joining floor panels according to a third embodiment of the invention.

FIG. 6 shows in perspective and from below a first variant for mounting a strip on a floor panel.

FIG. 7 shows in section a second variant for mounting a strip on a floor panel. [40]

DESCRIPTION OF PREFERRED EMBODIMENTS

FIGS. 1*a* and 1*b*, to which reference is now made, [45] illustrate a first floor panel 1, hereinafter termed strip panel, and a second floor panel 2, hereinafter termed groove panel. The terms "strip panel" and "groove panel" are merely intended to facilitate the description of the invention, the panels 1, 2 normally being identical in practice. The panels [50] 1 and 2 may be made from compact laminate and may have a thickness of about 3 mm with a thickness tolerance of about ± 0.2 mm. Considering this thickness tolerance, the panels 1, 2 are illustrated with different thicknesses (FIG. 1*b*), the strip panel 1 having a maximum thickness (3.2 mm) [55] and the groove panel 2 having a minimum thickness (2.8 mm).

To enable mechanical joining of the panels **1**, **2** at opposing joint edges, generally designated **3** and **4**, [60] respectively, the panels are provided with grooves and strips as described in the following.

Reference is now made primarily to FIGS. **1***a* and **1***b*, and secondly to FIGS. **4***a* and **4***b* showing the basic design of the floor panels from below, and from above, respectively. [65]

From the joint edge **3** of the strip panel **1**, i.e. the one long side, projects horizontally a flat strip **6** mounted at thee

[7]

factory on the underside of the strip panel **1** and extending throughout the entire edge **3**. The strip **6**, which is made of flexible, resilient sheet aluminum, can be fixed mechanically, by means of glue or in any other suitable a way. In FIGS. **1***a* and **1***b*, the strip **6** is glued, while in FIGS. [5] **4***a* and **4***b* it is mounted by means of a mechanical connection, which will be described in more detail hereinbelow.

Other strip materials can be used, such as sheets of other metals, as well as aluminum or plastics sections. [10] Alternatively, the strip **6** may be integrally formed with the strip panel **1**. At any rate, the strip **6** should be integrated with the strip panel **1** i.e. it should not be mounted on the strip panel **1** in connection with laying. As a non-restrictive example, the strip **6** may have a width of about 30 mm and [15] a thickness of about 0.5 mm.

As appears from FIGS. **4***a* and **4***b*, a similar, although shorter strip **6'** is provided also at one short side **3'** of the strip panel **1**. The shorter strip **6'** does however not extend throughout the entire short side **3'** but is otherwise identical [20] with the strip **6** and, therefore, is not described in more detail here.

The edge of the strip **6** facing away from joint edge **3** is formed, with a locking element **8** extended throughout the

entire strip **6**. The locking element **8** has a locking surface **10** [25] facing the joint edge **3** and having a height of e.g. 0.5 mm. The locking element **8** is so designed that when the floor is being laid and the strip panel **2** of FIG. **1***a* is pressed with its joint edge **4** against the joint edge **3** of the strip panel **1** and is angled down against the subfloor **12** according to FIG. **1***b*, [30] it enters a locking groove **14** formed in the underside **16** of the groove panel **2** and extending parallel to and spaced from the joint edge **4**. In FIG. **1***b*, the locking element **8** and the locking groove **14** together form a mechanical connection locking the panels **1**, **2** to each other in the direction [35] designated D2. More specifically, the locking surface **10** of the locking element **8** serves as a stop with respect to the surface of the locking groove **14** closest to the joint edge **4**.

When the panels **1** and **2** are joined together, they can however occupy such a relative position in the direction D2 [40] that there is a small play A between the locking surface **10** and the locking groove **14**. This mechanical connection in the direction D2 allows mutual displacement of the panels **1**, **2** in the direction of the joint, which considerably facilitates the laying and enables joining together the short sides by [45] snap action.

As appears from FIGS. **4***a* and **4***b*, each canal in the system has a strip **6** at one long side **3** and a locking groove **14** at the other long side **4**, as well as a strip **6'** at one short side **3'** and a locking groove **14'** at the other short side **4'**. [50]

Furthermore, the joint edge **3** of the strip panel **1** has in its underside **18** a recess **20** extending throughout the entire joint edge **3** and forming together with the upper face **22** off the strip **6** a laterally open recess **24**. The joint edge **4** of the [55] groove panel **2** has in its top side **26** a corresponding recess **28** forming a locking tongue **30** to be accommodated in the recess **24** so as to form a mechanical connection locking the joint edges **3**, **4** to each other in the direction designated D1.

This connection can be achieved with other designs of the [60] joint edges **3**, **4**, for example by a bevel thereof such that the joint edge **4** of the groove panel **2** passes obliquely in underneath the joint edge **3** of the strip panel **1** to be locked between that edge and the strip **6**.

The panels **1**, **2** can be taken up in the reverse order of [65] laying without causing any damage to the joint, and be laid again.

[8]

The strip **6** is mounted in a tolerance-equalising groove **40** in the underside **18** of the strip panel **1** adjacent the joint edge **3**. In this embodiment, the width of the equalizing groove **40** is approximately equal to half the width of the strip **6**, i.e. about 15 mm. By means of the equalising groove [5] **40**, it is ensured that there will always exist between the top side **21** of the panel **1** and the bottom of the groove **40** an exact, predetermined distance E which is slightly smaller than the minimum thickness (2.8 mm) of the floor panels **1**, **2**. The groove panel **2** has a corresponding tolerance- [10] equalising surface or groove **42** in the underside **16** of the joint edge **4**. The distance between the equalising surface **42** and the top side **26** of the groove panel **2** is equal to the aforementioned exact distance E. Further, the thickness of the strip **6** is so chosen that the underside **44** of the strip is [15] situated slightly below the undersides **18** and **16** of the floor panels **1** and **2**, respectively. In this manner, the entire joint will rest on the strip **6**, and all vertical downwardly-directed forces will be efficiently transmitted to the subfloor **12** without any stresses being exerted on the joint edges **3**, **4**. [20] Thanks to the provision of the equalising grooves **40**, **42**, an entirely even joint will be achieved on the top side, despite the thickness tolerances of the panels **1**, **2**, without having to perform any grinding or the like across the whole panels.

Especially, this obviates the risk of damage to the bottom [25] layer of the compact laminate, which might give rise to bulging of the panels.

Reference is now made to the embodiment of FIGS. **2***a-c* showing in a succession substantially the same laying method as in FIGS. **1***a* and **1***b*. The embodiment of FIGS. [30] **2***a-c* primarily differs from the embodiment of FIGS. **1***a* and **1***b* in that the strip **6** is mounted on the strip panel **1** by means of a mechanical connection instead of glue. To provide this mechanical connection, illustrated in more detail in FIG. **6**, a groove **30** is provided in the underside **18** of the strip panel [35] **1** at a distance from the recess **24**. The groove may be formed either as a continuous groove extending throughout the entire length of the panel **1**, or as a number of separate grooves. The groove defines, together with the recess **24**, a dovetail gripping edge, the underside of which exhibits [40] an exact equalising distance E to the top side **21** of the strip panel **1**. The aluminum strip 6 has a number of punched and bent tongues **54**, as well as one or more lips **56** which are bent round opposite sides of the gripping edge **52** in clamping engagement therewith. This connection is shown in [45] detail from below in the perspective view of FIG. **6**.

Alternatively, a mechanical connection between the strip **6** and the strip panel **1** can be provided as illustrated in FIG. **7** showing in section a cut-away part of the strip panel **1** turned upside down. In FIG. **7**, the mechanical connection [50] comprises a dovetail recess **53** in the underside **18** of the strip panel **1**, as well as tongues/lips **60** punched and bent from the strip **6** and clamping against opposing inner sides of the recess **58**.

The embodiment of FIGS. **2***a-c* is further characterised in [55] that the locking element **8** of the strip **6** is designed as a component bent from the aluminum sheet and having an operative locking surface **10** extending at right angles up from the front side **22** of the strip **6** through a height of e.g. 0.5

mm and a rounded guide surface **34** facilitating the [60] insertion of the locking element **8** into the locking groove when angling down the groove panel **2** towards the subfloor **12** (FIG. **2***b*), as well as a portion **36** which is inclined towards the subfloor **12** and which is not operative in the laying method illustrated in FIGS. **2***a-c*. [65]

Further, it can be seen from FIGS. **2***a-c* that the joint edge **3** of the strip panel **1** has a lower bevel **70** which cooperates

[9]

during laying with a corresponding upper bevel **72** of the joint edge **4** of the groove panel **2**, such that the panels **1** and **2** are forced to move vertically towards each other when their joint edges **3**, **4** are moved up to each other and the panels are pressed together horizontally. [5]

Preferably, the locking surface **10** is so located relative to the joint edge **3** that when the groove panel **2**, starting from the joined position in FIG. **2***c*, is pressed horizontally in the direction D2 against the strip panel **1** and is turned angularly up from the strip **6**, the maximum distance between the axis [10] of rotation A of the groove panel **2** and the locking surface **10** of the locking groove is such that the locking element **8** can leave the locking groove **14** without coming into contact with it.

FIGS. **3***a-b* show another joining method for mechanically [15] joining together the floor panels of FIGS. **2***a-c*. The method illustrated in FIGS. **3***a-c* relies on the fact that the strip **6** is resilient and is especially useful for joining together the short sides of floor panels which have already been joined along one long side as illustrated in FIGS. **2***a-c*. The [20] method of FIGS. **3***a-c* is performed by first placing the two panels **1** and **2** flat on the subfloor **12** and then moving them horizontally towards each other according to FIG. **3***b*. The inclined portion **36** of the locking element **6** then serves as a

guide surface which guides the joint edge **4** of the groove [25] panel **2** up on to the upper side **22** of the strip **6**. The strip **6** will then be urged downwards while the locking element **8** is sliding on the equalising surface **42**. When the joint edges **3**, **4** have been brought into complete engagement with each other horizontally, the locking element **8** will snap [30] into the locking groove **14** (FIG. 3*c*), thereby providing the same locking as in FIG. 2*c*. The same locking method can also be used by placing, in the initial position, the joint edge **4** of the groove panel with the equalising groove **42** on the locking element **10** (FIG. 3*a*). The inclined portion **36** of the [35] locking element **10** then is not operative. This technique thus makes it possible to lock the floor panels mechanically in all directions, and by repeating the laying operations the whole floor can be laid without using any glue.

The invention is not restricted to the preferred embodiments [40] described above and illustrated in the drawings, but several variants and modifications thereof are conceivable within the scope of the appended claims. The strip **6** can be divided into small sections covering the major part of the joint length. Further, the thickness of the strip **6** may vary [45] throughout its width. All strips, locking grooves, locking elements and recesses are so dimensioned as to enable laying the floor panels with flat top sides in a manner to rest on the strip **6** in the joint. If the floor panels consist of compact laminate and if silicone or any other sealing [50] compound, a rubber strip or any other sealing device is applied prior to laying between the fiat projecting part of the strip **6** and the groove panel **2** and/or in the recess **26**, a moisture-proof floor is obtained.

As appears from FIG. **6**, an underlay **46**, e.g. of floor [55] board, foam or felt, can be mounted on the underside of the, panels during the manufacture thereof. In one embodiment, the underlay **46** covers the strip **6** up to the locking element **8**,

such that the joint between the underlay **46** becomes offset in relation to the joint between the joint edges **3** and **4**. [60]

In the embodiment of FIG. **5**, the strip **6** and its locking element **8** are integrally formed with the strip panel **1**, the projecting part of the strip **6** thus forming an extension of the lower part of the joint edge **3**. The locking function is the [65] same as in the embodiments described above. On the underside **18** of the strip panel **1**, there is provided a separate strip,

[10]

band or the like **74** extending throughout the entire length of the joint and having, in this embodiment, a width coveting approximately the same surface as the separate strip **6** of the previous embodiments. The strip **74** can be provided directly on the rear side **18** or in a recess formed therein (not shown), [5] so that the distance from the front side **21**, **26** of the floor to the rear side **76**, including the thickness of the strip **74**, always is at least equal to the corresponding distance in the panel having the greatest thickness tolerance. The panels **1**, **2** will then rest, in the joint, on the strip **74** or only on the [10] undersides **18**, **16** of the panels, if these sides are made plane.

When using a material which does not permit downward bending of the strip **6** or the locking element **8**, laying can be performed in the way shown in FIG. **5**. A floor panel **2*a*** [15] is moved angled upwardly with its long side **4*a*** into engagement with the long side **3** of a previously laid floor panel **1** while at the same time a third floor panel **2*b*** is moved with its short side **4*b*'** into engagement with the short side **3*a*'** of the upwardly-angled floor panel **2*a*** and is fastened by [20] angling the panel **2*b*** downwards. The panel **2*b*** is then pushed along the short side **3*a*'** of the upwardly-angled floor panel **2*a*** until its long side **4*b*** encounters the long side **3** of the initially-laid panel **1**. The two upwardly-angled panels **2*a*** and

2*b* are therefore angled down on to the subfloor **12** [25] so as to bring about locking.

By a reverse procedure the panels can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again.

Several variants of preferred laying methods are conceivable. [30] For example, the strip panel can be inserted under the groove panel, thus enabling the laying of panels in all four directions with respect to the initial position.

I claim:

1. A method for laying and mechanically joining rectangular [35] building panels in parallel rows, the method comprising the steps of:

(a) providing a plurality of rectangular building panels having long edges and short edges,

said panels being provided with first locking means for [40] mechanically locking together their long edges and their short edges in a first direction at right angles to a principal plane of the panels,

the panels further including second locking means including: [45]

a locking strip at a first long edge and at a first short edge at a bottom side of each of the panels, and

a locking groove at a second long edge of each of the panels, opposite the first long edge, and a locking groove at a second short edge of each of the [50] panels, opposite the first short edge,

each of the locking grooves extending parallel to and spaced from the corresponding second edge and being open at the bottom side of the panel,

and each locking strip being integrated with the [55] panel and extending throughout substantially an entire length of the corresponding first edge,

a locking element projecting from each of the locking strips, such that when two adjacent panels

have been mechanically joined together along [60]adjacent edges thereof, one of the locking strips of one of the panels extends under the bottom side of an adjacent one of the panels with the locking element of said strip being received in the locking groove of the adjacent one of the panels, thereby [65] mechanically connecting the one panel and the adjacent one panel to each other in a second

[11]

direction parallel to said principal plane and at right angles to the joined edges;

(b) placing a new one of the panels adjacent to a long edge of a previously laid first one of [5] the panels in a first row and to a short edge of a previously laid second one of the panels in an adjacent second row, such that the new one of the panels is in the second row, while holding the new one of the panels at an angle relative to a principal plane of the first panel, such that the new one of the panels is spaced from its final longitudinal position [10] relative to said second panel and such that the long edge of the new panel provided with a locking groove is placed upon and in contact with a locking strip at the adjacent long edge of the first panel;

(c) subsequently angling down the new one of the panels [15] so as to accommodate the locking element of the strip of the first panel in the locking groove of the new panel, whereby the new panel and the first panel are mechanically connected with each other in the second direction with respect to the thus connected long edges, wherein [20] the long edges, in the angled down position of the new panel, are in engagement

with each other and thereby mechanically locked together in the first direction also; and

(d) displacing the new one of the panels in its longitudinal direction relative to the first panel towards a final [25] longitudinal position wherein the locking element of one of the short edges of the new one of the panels and the second panel snaps up into the locking groove of the other one of the short edges, whereby the new one of the panels and the second panel are mechanically [30] connected with each other in both in the first direction and in the second direction with respect to the thus-connected short edges.

2. The method as claimed in claim **1**, wherein the displacing step includes bending the locking strip located at the [35] short edges to be locked together downwards as a result of displacing the new panel, until the locking element snaps up into the locking groove.

3. The method as claimed in claim **1**, wherein the displacing step includes engaging the locking groove of the [40] short edge of the new panel to be locked to the short edge of the second panel with the locking element of the short edge of the second panel.

4. The method as claimed in claim **3**, wherein the angling step includes angling the new panel down into a position [45] where the end portion of the new panel facing the second panel is placed upon and in contact with the locking strip at the short edge of the second panel.

5. The method as claimed in claim **1**, wherein the displacing step includes engaging the locking element of the [50] short edge of the new one of the panels to be locked to the short edge of the second panel with the locking groove of the short edge of the second panel.

6. The method as claimed in claim **1**, further comprising the step of taking up the new one of the panels, after having

[55] been laid and mechanically joined to the first and to the second panel, by angling the new one of the panels and the second panel together in relation to the first panel and subsequently loosening the new one of the panels from the second panel by angling and/or displacing the new one of the [60] panels in relation to the second panel.

7. The method as claimed in claim **1**, wherein the providing step includes providing panels wherein the strips are made of a material different from that of the panels and are fixedly mounted on the panels at the factory. [65]

8. The method as claimed in claim **1**, wherein the providing step includes providing panels wherein the strips are

[12]

integrally formed with the panels, i.e., made in one piece with the panels.

9. The method as claimed in claim **1**, wherein the method includes making a floor from the building panels.

10. A method for laying and mechanically joining rectangular [5] building panels in parallel rows, the method comprising the steps of:

(a) providing a plurality of rectangular building panels having long edges and short edges,

said panels being provided with first locking means for [10] mechanically locking together their long edges and their short edges in a first direction at right angles to a principal plane of the panels,

the panels further including second locking means including: [15]

a locking strip at a first long edge and at a first short edge at a bottom side of each of the panels, and

a locking groove at a second long edge of each of the panels, opposite the first long edge, and a locking

groove at a second short edge of each of the [20] panels, opposite the first short edge,

each of the locking grooves extending parallel to and spaced from the corresponding second edge and being open at the bottom side of the panel,

and each locking strip being integrated with the [25] panel and extending throughout substantially an entire length of the corresponding first edge,

a locking element projecting from each of the locking strips, such that when two adjacent panels have been mechanically joined together along [30] adjacent edges thereof, one of the locking strips of one of the panels extends under the bottom side of an adjacent one of the panels with the locking element of said strip being received in the locking groove of the adjacent one of the panels, thereby [35] mechanically connecting the one panel and the adjacent one panel to each other in a second direction parallel to said principal plane and at right angles to the joined edges;

(b) placing a new one of the panels adjacent to a long edge [40] of a previously laid first one of the panels in a first row and to a short edge of a previously laid second one of the panels in an adjacent second row, such that the new one of the panels is in the second row, while holding the new one of the panels at an angle relative to a principal [45] plane of the first panel, such that the new one of the panels is spaced from its final longitudinal position relative to the second panel and such that a locking strip provided at a long edge of the new one of the panels is inserted under the adjacent long edge of the first panel [50] being provided with a locking groove;

(c) subsequently angling down the new one of the panels so as to accommodate the locking element of the strip of the new one of the panels in the locking

groove of the first panel, whereby the new one of the panels and [55] the first panel are mechanically connected with each other in the second direction with respect to the thus connected long edges, wherein the long edges, in the angled down position of the new one of the panels, are in engagement with each other and thereby mechanically [60] locked together in the first direction also; and

(d) displacing the new one of the panels in its longitudinal direction relative to the first panel towards the final position until the locking element of one of the short edges of the new one of the panels and the second panel [65] snaps up into the locking groove of the other one of the short edges, whereby the new one of the panels and the

[13]

second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus connected short edges.

11. The method as claimed in claim **10**, wherein the [5] displacing step includes bending the locking strip located at the short edges to be locked together downwards as a result of displacing the new one of the panels, until the locking element snaps up into the locking groove.

12. The method as claimed in claim **10**, wherein the [10] displacing step includes engaging the locking groove of the short edge of the new one of the panels to be locked to the short edge of the second panel with the locking element of the short edge of the second panel.

13. The method as claimed in claim **12**, wherein the [15] angling step includes angling the new panel down into a position where the end portion of the new one of the panels

facing the second panel is placed upon and in contact with the locking strip at the short edge of the second panel.

14. The method as claimed in claim **10**, wherein the [20] displacing step includes engaging the locking element of the short edge of the new one of the panels to be locked to the short edge of the second panel with the locking groove of the short edge of the second panel.

15. The method as claimed in claim **10**, further comprising [25] the step of taking up the new one of the panels, after having been laid and mechanically joined to the first and to the second panel, by angling the new one of the panels and the second panel together in relation to the first panel and subsequently loosening the new one of the panels from the [30] second panel by angling and/or displacing the new one of the panels in relation to the second panel.

16. The method as claimed in claim **10**, wherein the poviding step includes providing panels wherein the strips are made of a material different from that of the panels and [35] are fixedly mounted on the panels at the factory.

17. The method as claimed in claim **10**, wherein the providing step includes providing panels wherein the strips are integrally formed with the panels, i.e., made in one piece with the panels. [40]

18. The method as claimed in claim **10**, wherein the method includes making a floor from the building panels.

19. A method for laying and mechanically joining rectangular building panels in parallel rows, the method comprising the steps of: [45]

(a) placing a new one of the panels adjacent to a long edge of a previously laid first one of the panels in a first row and to a short edge of a previously laid second one of the panels in an adjacent second row, such that the [50] new one of the panels is in the second row, while holding the new one of the panels at an angle relative to a principal plane of the first

panel, such that the new one of the panels is spaced from its final longitudinal position relative to said second panel and such that a long edge of the new panel is provided with a locking groove [55] which is placed upon and in contact with a locking strip at the adjacent long edge of the first panel;

(b) subsequently angling down the new one of the panels so as to accommodate a locking element of the strip of the first panel in the locking groove of the new panel, [60]whereby the new panel and the first panel are mechanically connected with each other in a second direction with respect to the thus connected long edges, wherein the long edges, in the angled down position of the new panel, are in engagement with each other and thereby [65] mechanically locked together in a first direction also; and

[14]

(c) displacing the new one of the panels in its longitudinal direction relative to the first panel towards a final longitudinal position until a locking element of one of the short edges of the new one of the panels and the second panel snaps up into a locking groove of the [5] other one of the short edges, whereby the new one of the panels and the second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus connected short edges. [10]

20. The method as claimed in claim **19**, wherein the displacing step includes bending downwards the locking strip located at the end portion to be locked together as a result of displacing the new panel, until the locking element snaps up into the locking groove. [15]

21. The method as claimed in claim **19**, wherein the angling step includes angling the new panel down into a position where the short edge of the another set of edges of the new panel is placed upon and in contact with the locking strip at the short edge of the second panel. [20]

22. The method as claimed in claim **19**, further comprising the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel together in relation to the first panel and subsequently [25] loosening the new panel from the second panel by angling and/or displacing the new panel in relation to the second panel.

23. A method for laying and mechanically joining rectangular building panels in parallel rows, the method comprising [30] the steps of:

(a) placing a new one of the panels adjacent to a long edge of a previously laid first one of the panels in a first row and to a short edge of a previously laid second one of the panels in an adjacent second row, such that the new [35] one of the panels is in the second row, while holding the new one of the panels at an angle relative to a principal plane of the first panel, such that the new one of the panels is spaced from its final longitudinal position relative to the second panel and such that a first locking [40] element provided at a long edge of the new one of the panels is inserted under the adjacent long edge of the first panel being provided with a second locking element;

(b) subsequently angling down the new one of the panels [45] so as to accommodate the locking element of the new one of the panels in the locking element of the first panel, whereby the new one of the panels and the first panel are mechanically connected with each other in a second direction with respect to the thus

connected [50] long edges, wherein the long edges, in the angled down position of the new one of the panels, are in engagement with each other and thereby mechanically locked together in a first direction also; and

(c) displacing the new one of the panels in its longitudinal [55] direction relative to the first panel towards the final position until a locking element of one of the short edges of the new one of the panels and the second panel snaps up into a locking groove of the other one of the short edges, whereby the new one of the panels and the [60] second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus connected short edges.

24. The method as claimed in claim **23**, wherein the [65] displacing step includes bending downwards the locking strip located at the end portion to be locked together as a

[15]

result of displacing the new panel, until the locking element snaps up into the locking groove.

25. The method as claimed in claim **23**, wherein the angling step includes angling the new panel down into a position where the short edge of the another set of edges of [5] the new panel is placed upon and in contact with the locking strip at the short edge of the second panel.

26. The method as claimed in claim **23**, further comprising the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel [10] together in relation to the first panel and subsequently loosening the new panel from the second panel by angling

and/or displacing the new panel in relation to the second panel.

27. A method for laying and mechanically joining rectangular [15] building panels in parallel rows, the method comprising the steps of:

(a) providing a plurality of rectangular building panels having one set of edges and another set of edges,

said panels being provided with first locking means for [20] mechanically locking together their one set of edges and their another set of edges in a first direction at right angles to a principal plane of the panels,

the panels further including second locking means including: [25]

a locking strip at a first edge of the one set of edges and at a first edge of the another set of edges at a bottom side of each of the panels, and

a locking groove at a second edge of the one set of edges of each of the panels, opposite the first edge [30]of the one set of edges, and a locking groove at a second edge of the another set of edges of each of the panels, opposite the first edge of the another set of edges,

each of the locking grooves extending parallel to and [35] spaced from the corresponding second edge and being open at the bottom side of the panel,

and each locking strip being integrated with the panel and extending throughout substantially an entire length of the corresponding first edge, [40]

a locking element projecting from each of the locking strips, such that when two adjacent panels have been mechanically joined together along adjacent edges thereof, one of the locking strips of one of the panels extends under the bottom side of [45] an

adjacent one of the panels with the locking element of said strip being received in the locking groove of the adjacent one of the panels, thereby mechanically connecting the one panel and the adjacent one panel to each other in a second [50] direction parallel to said principal plane and at right angles to the joined edges;

(b) placing a new one of the panels adjacent to one edge of the one set of edges of a previously laid first one of the panels in a first row and to one edge of the another [55] set of edges of a previously laid second one of the panels in an adjacent second row, while holding the new panel at an angle relative to a principal plane of the first panel, such that the new panel is spaced from its final position relative to said second panel in a direction [60] parallel to said principal plane and such that the second edge of the one set of edges of the new panel provided with a locking groove is placed upon and in contact with a locking strip at the adjacent first edge of the one set of edges of the first panel; [65]

(c) subsequently angling down the new panel so as to accommodate the locking element of the strip of the

first panel in the locking groove of the new panel, whereby the new panel and the first panel are mechanically connected with each other in the second direction with respect to the thus connected edges [5] of the new panel and the first panel, wherein the connected edges, in the angled down position of the new panel, are in engagement with each other and thereby mechanically locked together in the first direction also; and

(d) displacing the new panel relative to the first panel in a direction parallel with the connected edges of the new [10] panel and the first panel towards a final position wherein the locking element of one of the another set of edges of the new panel and the second panel snaps up into the locking groove of the other one of the another set of edges, whereby the new panel and the [15] second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus-connected edges of the new panel and the second panel.

28. The method as claimed in claim **27**, wherein the [20] displacing step includes bending the locking strip located at the another set of edges to be locked together downwards as a result of displacing the new panel, until the locking element snaps up into the locking groove.

29. The method as claimed in claim **27**, wherein the [25] angling step includes angling the new panel down into a position where the second edge of the another set of edges of the new panel is placed upon and in contact with the locking strip at the first edge of the another set of edges of the second panel. [30]

30. The method as claimed in claim **27**, further comprising the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel together in relation to the first panel and subsequently [35] loosening the new panel from the second panel by angling and/or displacing the new panel in relation to the second panel.

31. A method for laying and mechanically joining rectangular building panels in parallel rows, the method comprising [40] the steps of:

(a) providing a plurality of rectangular building panels having one set of edges and another set of edges, said panels being provided with first locking means for mechanically locking together their one set of edges [45] and their another set of edges in a first direction at right angles to a principal plane of the panels,

the panels further including second locking means including: a locking strip at a first edge of the one set of edges and at a [50] first edge of the another set of edges at a bottom side of each of the panels, and

a locking groove at a second edge of the one set of edges of each of the panels, opposite the first edge of the one set of edges, and a locking groove at a [55] second edge of the another set of edges of each of the panels, opposite the first edge of the another set of edges,

each of the locking grooves extending parallel to and spaced from the corresponding second edge and [60] being open at the bottom side of the panel,

and each locking strip being integrated with the panel and extending throughout substantially an entire length of the corresponding first edge,

a locking element projecting from each of the locking [65] strips, such that when two adjacent panels have been mechanically joined together along

adjacent edges thereof, one of the locking strips of one of the panels extends under the bottom side of an adjacent one of the panels with the locking element of said strip being received in the locking groove of the adjacent one of the panels, thereby [5] mechanically connecting the one panel and the adjacent one panel to

each other in a second direction parallel to said principal plane and at right angles to the joined edges;

(b) placing a new one of the panels adjacent to one edge [10] of the one set of edges of a previously laid first one of the panels in a first row and to one edge of the another set of edges of a previously laid second one of the panels in an adjacent second row, while holding the new panel at an angle relative to a principal plane of the [15] first panel, such that the new panel is spaced from its final position relative to the second panel in a direction parallel to the principal plane and such that a locking strip provided at one edge of the one set of edges of the new panel is inserted under the adjacent edge of the one [20] set of edges of the first panel being provided with a locking groove;

(c) subsequently angling down the new panel so as to accommodate the locking element of the strip of the new panel in the locking groove of the first panel, [25] whereby the new panel and the first panel are mechanically connected with each other in the second direction with respect to the thus connected edges of the new panel and the first panel, wherein the connected edges, in the angled down position of the new panel, are in [30] engagement with each other and thereby mechanically locked together in the first direction also; and

(d) displacing the new panel relative to the first panel in a direction parallel with said connected edges of the new panel and the first panel towards the final position [35] until the locking element of one of the another set of edges of the new panel and the another set of edges of the second panel snaps up into the locking groove of the other one of the another set of edges, whereby the new panel and the second panel

are mechanically connected [40] with each other in both the first direction and in the second direction with respect to the thus connected edges of the new panel and the second panel.

32. The method as claimed in claim **31**, wherein the displacing step includes bending the locking strip located at [45] the another set of edges to be locked together downwards as a result of displacing the new panel, until the locking element snaps up into the locking groove.

33. The method as claimed in claim **31**, wherein the angling step includes angling the new panel down into a [50] position where the second edge of the another set of edges of the new panel is placed upon and in contact with the locking strip at the first edge of the another set of edges of the second panel.

34. The method as claimed in claim **31**, further comprising [55] the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel together in relation to the first panel and subsequently loosening the new panel from the second panel by angling [60] and/or displacing the new panel in relation to the second panel.

35. A method for laying and mechanically joining rectangular building panels in parallel rows, the method comprising the steps of: [65]

(a) placing a new one of the panels adjacent to one edge of a previously laid first one of the panels in a first row

[18]

and to another edge of a previously laid second one of the panels in an adjacent second row, while holding the new panel at an angle relative to a principal plane

of the first panel, such that the new panel is spaced from its final position relative to said second panel in a direction [5] parallel to said principal plane and such that one edge of the new panel which is provided with a locking groove is placed upon and in contact with a locking strip at the adjacent one edge of the first panel;

(b) subsequently angling down the new panel so as to [10] accommodate a locking element of the locking strip of the first panel in the locking groove of the new panel, whereby the new panel and the first panel are mechanically connected with each other in a second direction with respect to the thus connected edges of the new [15] panel and the first panel, wherein the connected edges, in the angled down position of the new panel, are in engagement with each other and thereby mechanically tocked together in a first direction that is at right angles to the principal plane of the first panel also; and [20]

(c) displacing the new panel relative to the first panel in a direction parallel with said connected edges of the new panel and the first panel towards a final position until a locking element of one of an another edge of the new panel and the another edge of the second panel [25] snaps up into a locking groove of the other one of the another edges, whereby the new panel and the second panel are mechanically connected with each other in both in the first direction and in the second direction with respect to the thus connected set of another edges. [30]

36. The method as claimed in claim **35**, wherein the displacing step includes bending downwards the locking strip located at the another edges to be locked together as a result of displacing the new panel, until the locking element snaps up into the locking groove. [35]

37. The method as claimed in claim **35**, wherein the angling step includes angling the new panel down into a position where the second edge of the another set of edges of the new panel is placed upon and in contact with the locking strip at the first edge of the another set of edges of [40] the second panel.

38. The method as claimed in claim **35**, further comprising the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel [45] together in relation to the first panel and subsequently loosening the new panel from the second panel by angling and/or displacing the new panel in relation to the second panel.

39. A method for laying and mechanically joining rectangular [50] building panels in parallel rows, the method comprising the steps of:

(a) placing a new one of the panels adjacent to one edge of a previously laid first one of the panels in a first row and to another edge of a previously laid second one of [55] the panels in an adjacent second row, while holding the new panel at an angle relative to a principal plane of the first panel, such that the new panel is spaced from its final position relative to the second panel in a direction parallel to said principal plane and such that a first [60] locking member provided at one edge of the new panel is inserted under the adjacent one edge of the first panel being provided with a second locking member;

(b) subsequently angling down the new panel so as to engage the first locking member of the new panel with [65] the second locking member of the first panel, whereby the new panel and the first panel are mechanically

[19]

connected with each other in a second direction with respect to the thus connected edges of the new panel and the first panel, wherein the connected edges, in the angled down position of the new panel, are in engagement with each other and thereby mechanically locked [5] together in a first direction that is at right angles to the principal plane of the first panel also; and

(c) displacing the new panel relative to the first panel in a direction parallel with the connected edges of the new panel and the first panel towards a final position until a [10] locking element of one of an another edge of the new panel and the another edge of the second panel snaps up into a locking groove of the other one of the another edges, whereby the new panel and the second panel are mechanically connected with each other in both in the [15] first direction and in the second direction with respect to the thus connected edges of the new panel and the second panel.

40. The method as claimed in claim **39**, wherein the displacing step includes bending downwards the locking

[2O]

strip located at the another edges to be locked together as a result of displacing the new panel, until the locking element snaps up into the locking groove.

41. The method as claimed in claim **39**, wherein the angling step includes angling the new panel down into a [5] position where the second edge of the another set of edges of the new panel is placed upon and in contact with the locking strip at the first edge of the another set of edges of the second panel.

42. The method as claimed in claim **39**, further comprising [10] the step of taking up the new panel, after having been laid and mechanically joined to the first and to the second panel, by angling the new panel and the second panel together in relation to the first panel and subsequently loosening the new panel from the second panel by angling [15] and/or displacing the new panel in relation to the second panel.

* * * * *

APPENDIX G

UNITED STATES PATENT

Patent No. 6,182,410

See Fold Out Exhibit
Diagrams

US006182410B1

(12) **United States Patent**
Pervan

(10) **Patent No.: US 6,182,410 B1**
(45) **Date of Patent: *Feb. 6, 2001**

(54) **SYSTEM FOR JOINING BUILDING BOARDS**

(75) Inventor: **Tony Pervan**, Solna (SE)

(73) Assignee: **Välinge Aluminium AB**, Viken (SE)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/356,563**

(22) Filed: **Jul. 19, 1999**

Related U.S. Application Data

(62) Continuation of application No. 09/193,687, filed on Nov. 18, 1999, now Pat. No. 6,023,907, which is a continuation of application No. 09/003,499, filed on Jan. 6, 1998, now Pat. No. 5,860,267, which is a division of application No. 08/436,244, filed as application No. PCT/SE94/00386 on Apr. 29, 1994, now abandoned.

(30) **Foreign Application Priority Data**

May 10, 1993 (SE) 9301595-6

(51) **Int. Cl.**[7] **E04F 15/22**

(52) **U.S. Cl.** **52/403.1**; 52/480; 52/506.1; 52/506.05; 52/582.1; 52/592.2; 52/551

(58) **Field of Search** 52/403.1, 480, 52/506.05, 551, 591.3, 592.2, 582.1, 578, 506.09, 506.1

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Assistant Examiner—Yvonne M. Horton
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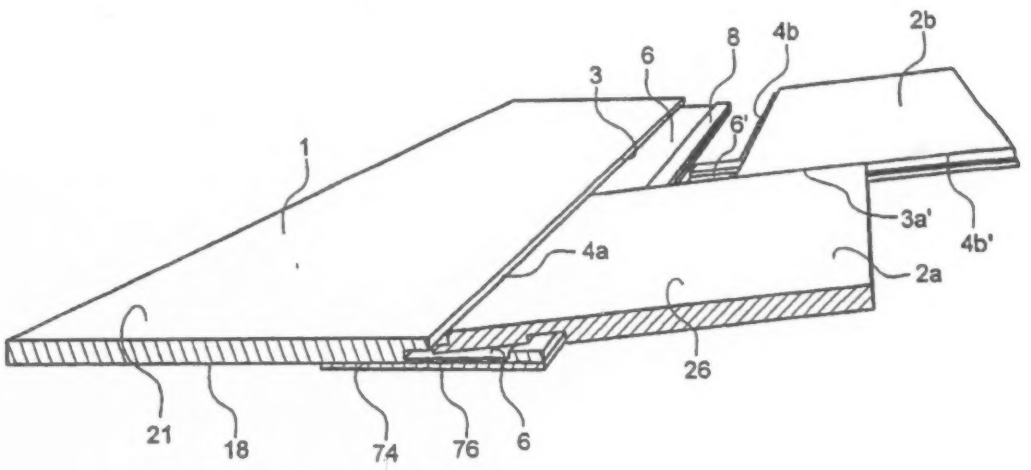
(57) **ABSTRACT**

An edge lock is provided for use in a flooring system having a plurality of floor panels. The edge lock mechanically and releasably locks together adjacent edges of pairs of adjacent floor panels during assembly of the flooring system, and when said adjacent floor panels are laying flat on a subfloor with upper corner portions of said adjacent edges being mutually spaced apart, the edge lock includes a lock for forming a first mechanical connection for locking the adjacent edges to each other in a vertical direction, and for forming a second mechanical connection for locking the adjacent edges to each other in a horizontal direction at right angles to the edges. The lock includes a locking groove extending parallel to and spaced from a first one of the adjacent edges of one of the adjacent floor panels and being open at a rear side of the one adjacent floor panel, and a flexible and resilient locking strip integrated with another of the adjacent floor panels.

61 Claims, 6 Drawing Sheets



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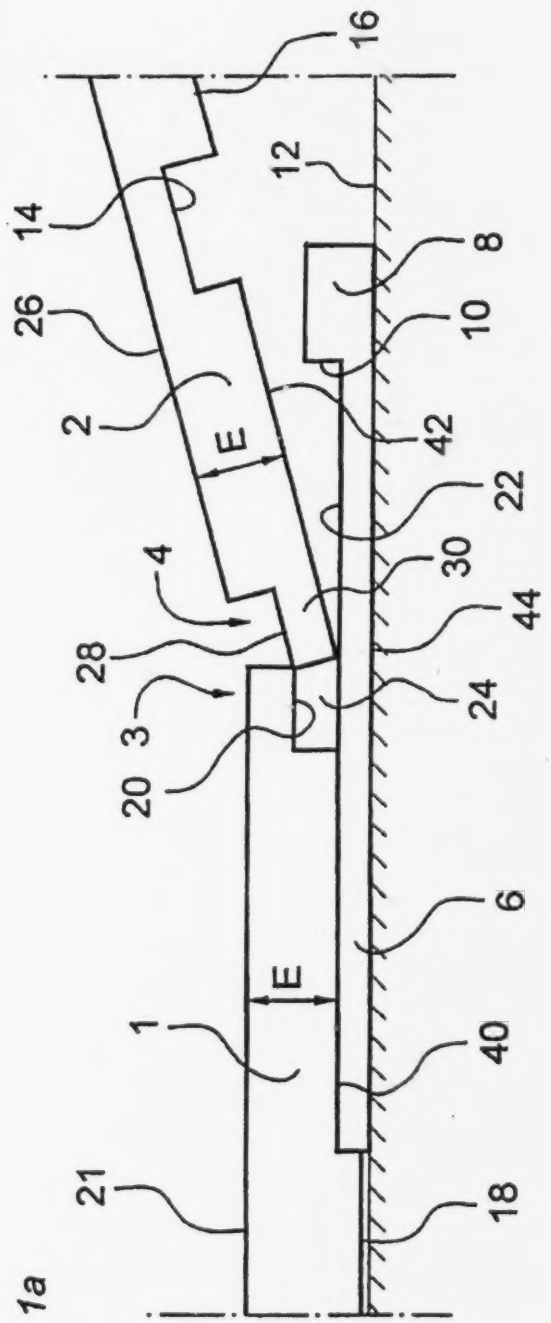
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Fig. 1a

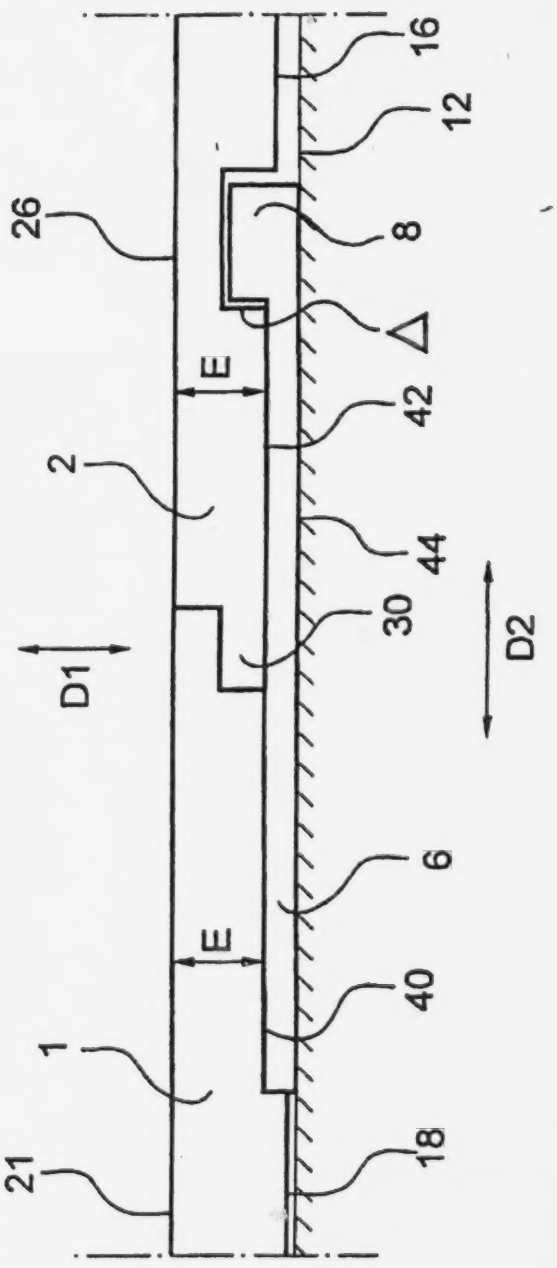
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Fig. 1b

Fig. 2a

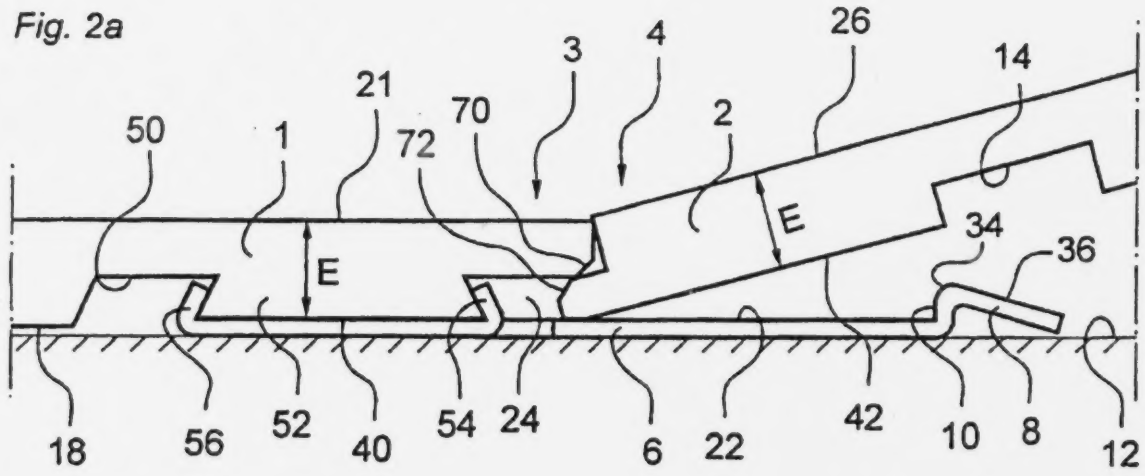


Fig. 2b

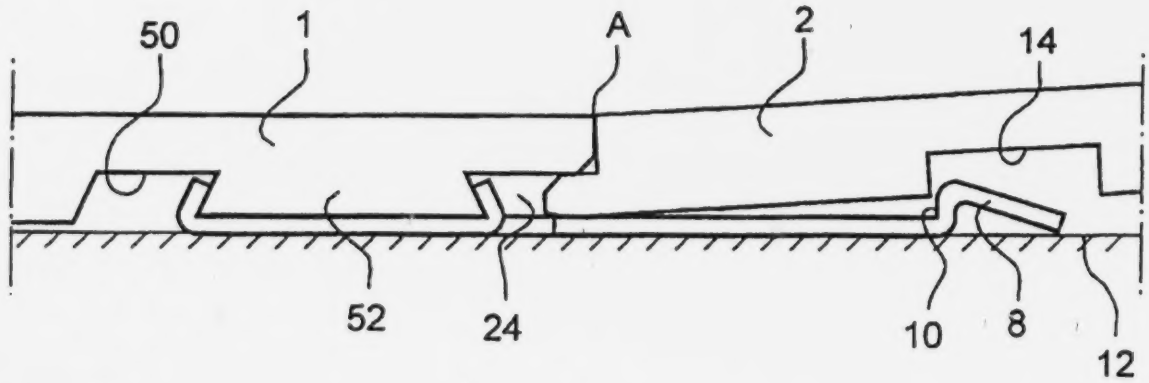


Fig. 2c

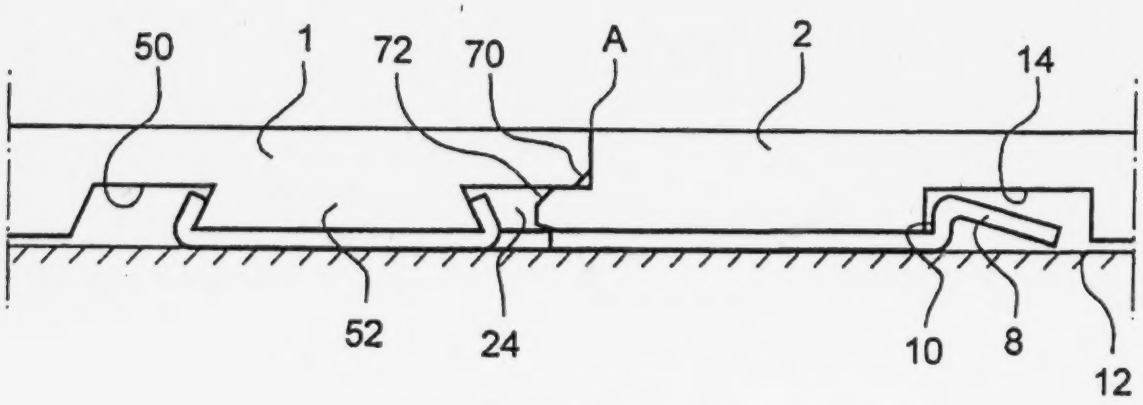


Fig. 3a

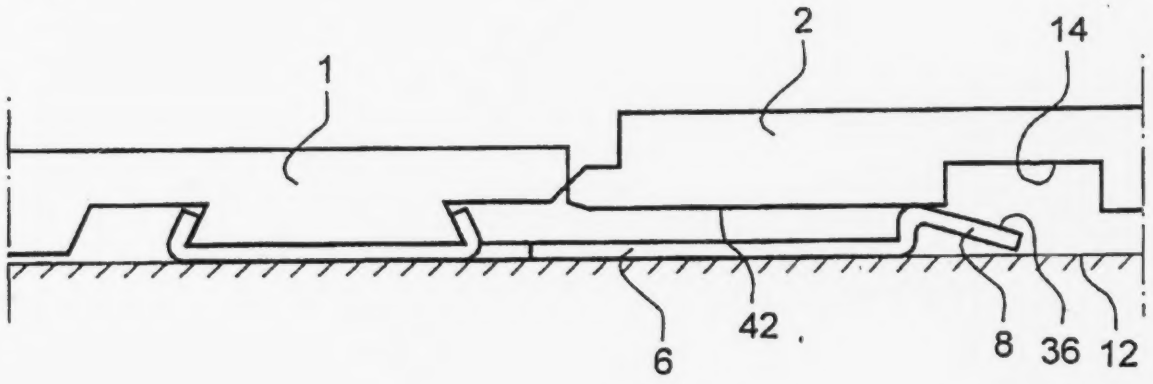


Fig. 3b

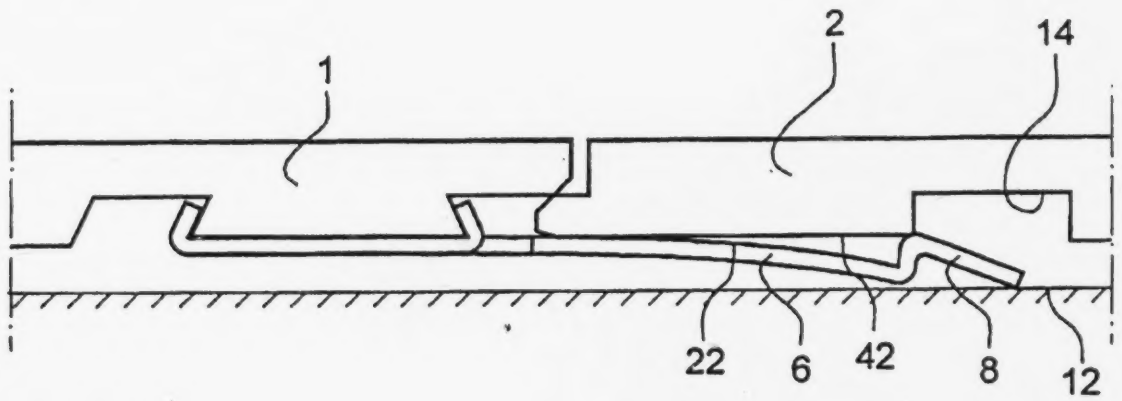


Fig. 3c

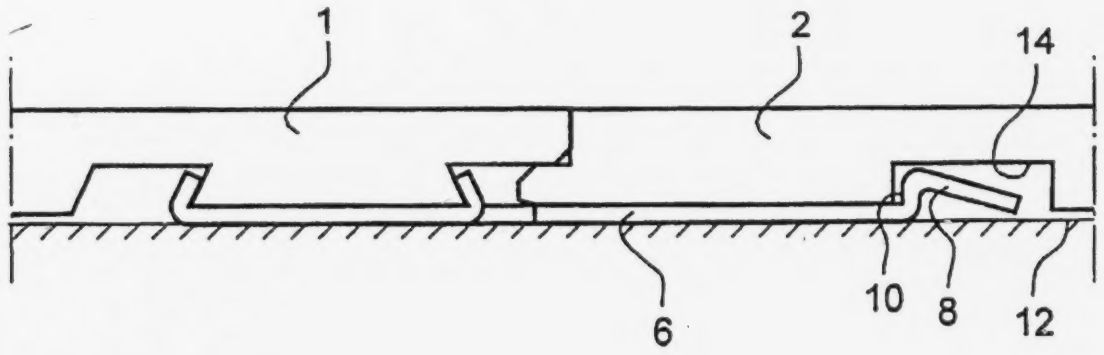


Fig. 4a

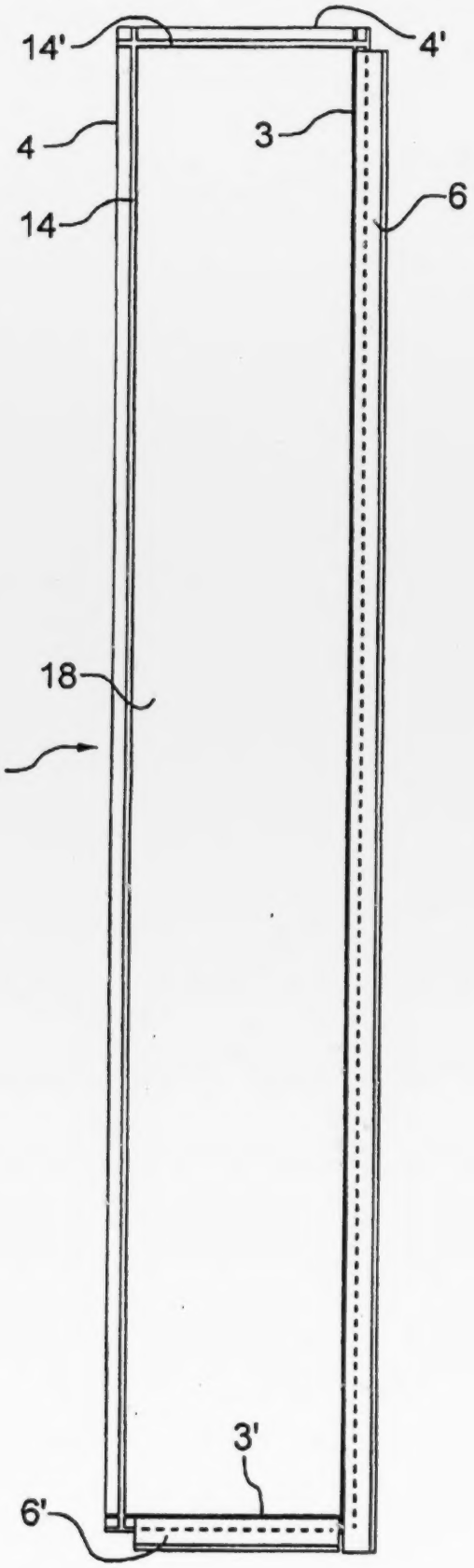
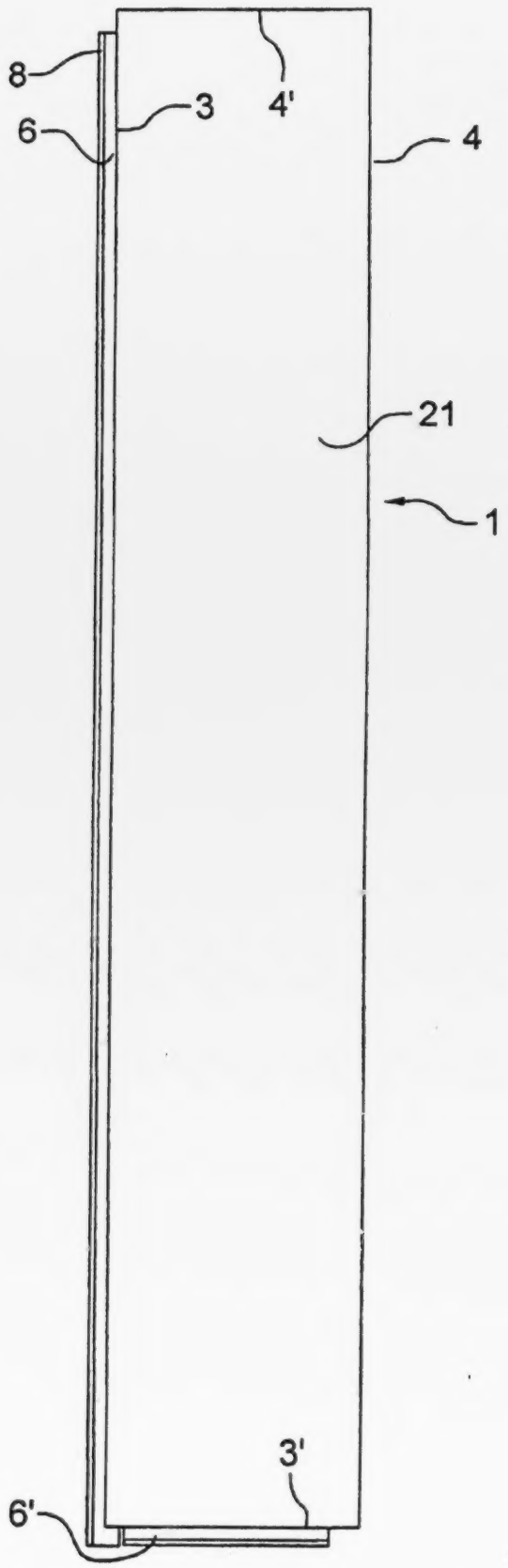


Fig. 4b



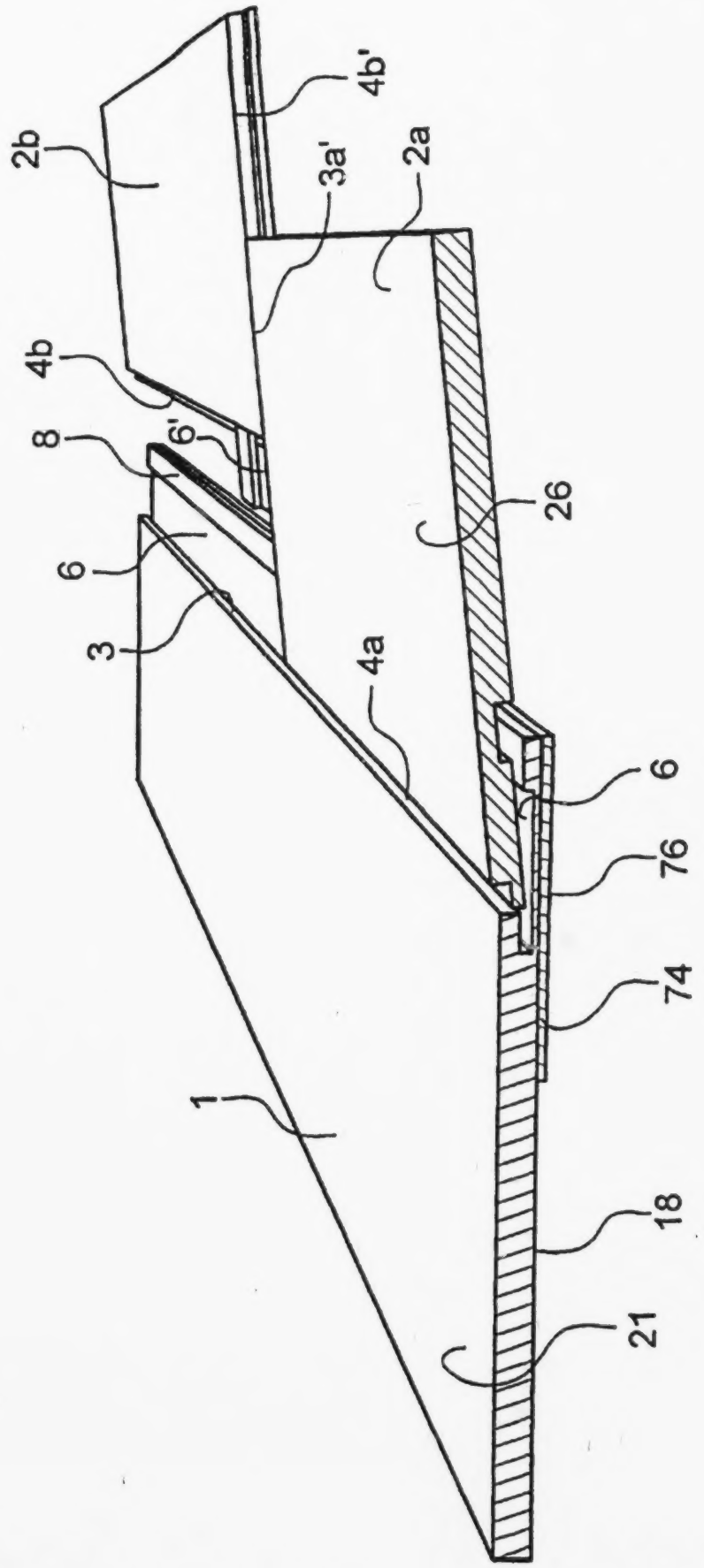


Fig. 5

Fig. 6

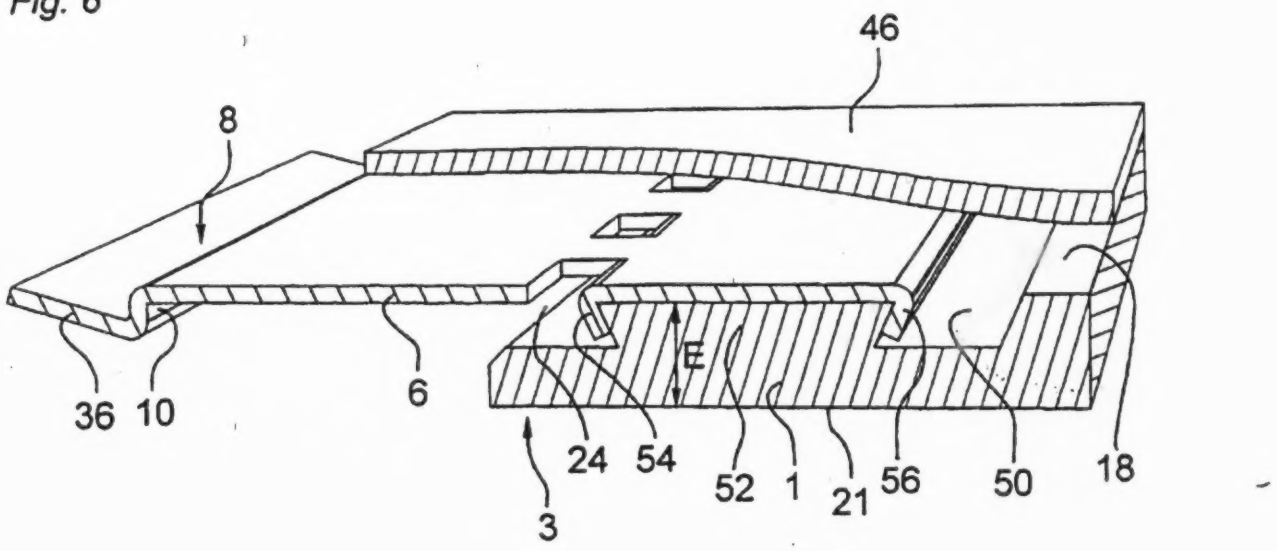
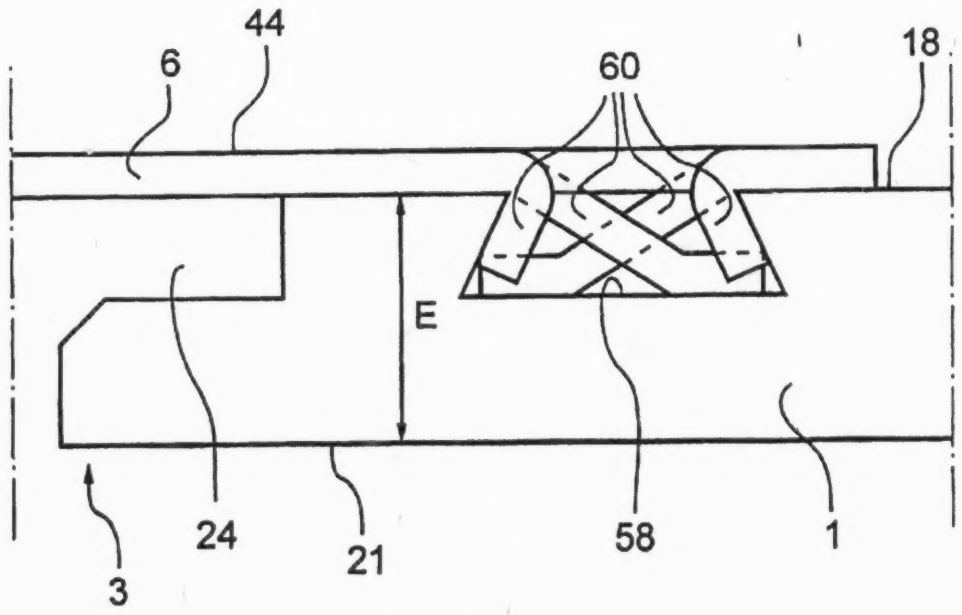


Fig. 7



US 6,182,410 B1

[1]

SYSTEM FOR JOINING BUILDING BOARDS

This application is a continuation of application Ser. No. 09/193,687, filed Nov. 18, 1999 now U.S. Pat. No. 6,023,907, which is a continuation of application Ser. No. 09/003, [5] 499 filed on Jan. 6, 1998 now U.S. Pat. No. 5,860,267 which is a divisional of application Ser. No. 08/436,244 filed on May 17, 1995 now abandoned, which is a 371 of PCT/SE94/00386 filed Apr. 29, 1994.

TECHNICAL FIELD[10]

The invention generally relates to a system for providing a joint along adjacent joint edges of two building panels, especially floor panels.

More specifically, the joint is of the type where the [15] adjacent joint edges together form a first mechanical connection locking the joint edges to each other in a first direction at right angles to the principal plane of the panels, and where a locking device forms a second mechanical connection locking the panels to each other in a second [20] direction parallel to the principal plane and at right angles to the joint edges, the locking device comprising a locking groove which extends parallel to and spaced from the joint edge of one of the panels, and said locking groove being open at the rear side of this one panel. [25]

The invention is especially well suited for use in joining floor panels, especially thin laminated floors. Thus, the following description of the prior art and of the objects and features of the invention will be focused on this field of use. It should however be emphasised that the invention is useful

[30] also for joining ordinary wooden floors as well as other types of building panels such as wall panels and roof slabs.

BACKGROUND OF THE INVENTION

A joint of the aforementioned type is known e.g. from SE [35] 450,141. The first mechanical connection is achieved by means of joint edges having tongues and grooves. The locking device for the second mechanical connection comprises two oblique locking grooves, one in the rear side of each panel, and a plurality of spaced-apart spring clips [40] which are distributed along the joint and the legs of which are pressed into the grooves, and which are biased so as to tightly clamp the floor panels together. Such a joining technique is especially useful for joining thick floor panels to form surfaces of a considerable expanse. [45]

Thin floor panels of a thickness of about 7-10 mm, especially laminated floors, have in a short time taken a substantial share of the market. All thin floor panels employed are laid as "floating floors" without being attached to the supporting structure. As a rule, the dimension of the 50 floor panels is 200x1200 mm, and their long and short sides are formed with tongues and grooves. Traditionally, the floor is assembled by applying glue in the groove and forcing the floor panels together. The tongue is then glued in the groove of the other panel. As a rule, a laminated floor consists of an [55] upper decorative wear layer of laminate having a thickness of about 1 mm, an intermediate core of particle board or other board, and a base layer to balance the construction. The core has essentially poorer properties than the laminate, e.g. in respect of hardness and water resistance, but it is [60] nonetheless needed primarily for providing a groove and tongue for assemblage. This means that the overall thickness must be at least about 7 mm. These known

laminated floors using glued tongue-and-groove joints however suffer from several inconveniences. [65]

First, the requirement of an overall thickness of at least about 7 mm entails an undesirable restraint in connection

[2]

with the laying of the floor, since it is easier to cope with low thresholds when using thin floor panels, and doors must often be adjusted in height to come clear of the floor laid. Moreover, manufacturing costs are directly linked with the [5] consumption of material.

Second, the core must be made of moisture-absorbent material to permit using water-based glues when laying the floor. Therefore, it is not possible to make the floors thinner using so-called compact laminate, because of the absence of [10] suitable gluing methods for such non-moisture-absorbent core materials.

Third, since the laminate layer of the laminated floors is highly wear-resistant, tool wear is a major problem when working the surface in connection with the formation of [15] the tongue.

Fourth, the strength of the joint, based on a glued tongue-and-groove connection, is restricted by the properties of the core and of the glue as well as by the depth and height of the groove. The laying quality is entirely dependent on the [20] gluing. In the event of poor gluing, the joint will open as a result of the tensile stresses which occur e.g. in connection with a change in air humidity.

Fifth, laying a floor with glued tongue-and-groove joints is time-consuming, in that glue must be applied to every [25] panel on both the long and short sides thereof.

Sixth, it is not possible to disassemble a glued floor once laid, without having to break up the joints. Floor panels that have been taken up cannot therefore be used again. This is a

drawback particularly in rental houses where the flat [30]concerned must be put back into the initial state of occupancy. Nor can damaged or worn-out panels be replaced without extensive efforts, which would be particularly desirable on public premises and other areas where parts of the floor are subjected to great wear.

[35]Seventh, known laminated floors are not suited for such use as involves a considerable risk of moisture penetrating down into the moisture-sensitive core.

Eighth, present-day hard, floating floors require, prior to laying the floor panels on hard subfloors, the laying of a [40] separate underlay of floor board, felt, foam or the like, which is to damp impact sounds and to make the floor more pleasant to walk on. The placement of the underlay is a complicated operation, since the underlay must be placed in edge-to-edge fashion. Different underlays affect the proper- [45] ties of the floor.

There is thus a strongly-felt need to overcome the above-mentioned drawbacks of the prior art. It is however not possible simply to use the known joining technique with glued tongues and grooves for very thin floors, e.g. with [50] floor thicknesses of about 3 mm, since a joint based on a tongue-and-groove connection would not be sufficiently strong and practically impossible to produce for such thin floors. Nor are any other known joining techniques usable for such thin floors. Another reason why the making of thin [55] floors from e.g. compact laminate involves problems is the thickness tolerances of the panels, being about 0.2-0.3 mm for a panel thickness of about 3 mm. A 3-mm compact laminate panel having such a thickness tolerance would have, in ground to uniform thickness on its rear side, an [60] unsymmetrical design, entailing the risk of bulging. Moreover, if the panels have different thicknesses, this also means that the joint will be subjected to excessive load.

Nor is it possible to overcome the above-mentioned problems by using double-adhesive tape or the like on the [65] undersides of the panels, since such a connection catches directly and does not allow for subsequent adjustment of the panels as is the case with ordinary gluing.

[3]

Using U-shaped clips of the type disclosed in the above-mentioned SE 450,141, or similar techniques to overcome the drawbacks discussed above is no viable alternative either. Especially, biased clips of this type cannot be used for joining panels of such a small thickness as 3 mm. Normally, [5] it is not possible to disassemble the floor panels without having access to their undersides. This known technology relying on clips suffers from the additional drawbacks:

Subsequent adjustment of the panels in their longitudinal direction is a complicated operation in connection with [10] laying, since the clips urge the panels tightly against each other.

Floor laying using clips is time-consuming.

This technique is usable only in those cases where the floor panels are resting on underlying joists with the [15] clips placed there between. For thin floors to be laid on a continuous, flat supporting structure, such clips cannot be used.

The floor panels can be joined together only at their long sides. No clip connection is provided on the short sides.[20]

TECHNICAL PROBLEMS AND OBJECTS OF THE INVENTION

A main object of the invention therefore is to provide a [25] system for joining together building panels, especially

floor panels for hard, floating floors, which allows using floor panels of a smaller overall thickness than present-day floor panels.

A particular object of the invention is to provide a [30] panel-joining system which

- makes it possible in a simple, cheap and rational way to provide a joint between floor panels without requiring the use of a glue, especially a joint based primarily only on mechanical connections between the panels; [35]
- can be used for joining floor panels which have a smaller thickness than present-day laminated floors and which have, because of the use of a different core material, superior properties than present-day floors even at a thickness of 3 mm; [40]
- makes it possible between thin floor panels to provide a joint that eliminates any unevennesses in the joint because of thickness tolerances of the panels;
- allows joining all the edges of the panels;
- reduces tool wear when manufacturing floor panels with[45] hard surface layers;
- allows repeated disassembly and reassembly of a floor previously laid, without causing damage to the panels, while ensuring high laying quality; [50]
- makes it possible to provide moisture-proof floors;
- makes it possible to obviate the need of accurate, separate placement of an underlay before laying the floor panels; and
- considerably cuts the time for joining the panels.[55]

These and other objects of the invention are achieved by means of a panel-joining system having the features recited in the appended claims.

Thus, the invention provides a system for making a joint along adjacent joint edges of two building panels, especially [60] floor panels, in which joint:

the adjacent joint edges together form a first mechanical connection locking the joint edges to each other in a first direction at right angles to the principal plane of the panels, and [65]

a locking device arranged on the rear side of the panels forms a second mechanical connection locking the panels to

each other in a second direction parallel to the principal plane and at right angles to the joint edges, said locking device comprising a locking groove which extends parallel to and spaced from the joint edge of one of said panels, [5] termed groove panel, and which is open at the rear side of the groove panel, said system being characterised in

that the locking device further comprises a strip integrated with the other of said panels, termed strip panel, said strip extending throughout substantially the entire [10] length of the joint edge of the strip panel and being provided with a locking element projecting from the strip, such that when the panels are joined together, the strip projects on the rear side of the groove panel with its locking element received in the locking groove of [15]the groove panel.

that the panels, when joined together, can occupy a relative position in said second direction where a play exists between the locking groove and a locking surface on the locking element that is facing the joint edges and [20] is operative in said second mechanical connection,

that the first and the second mechanical connection both allow mutual displacement of the panels in the direction of the joint edges, and

that the second mechanical connection is so conceived as [25]to allow the locking element to leave the locking groove if the groove panel is turned about its joint edge angularly away from the strip.

The term "rear side" as used above should be considered to comprise any side of the panel located behind underneath [30] the front side of the panel. The opening plane of the locking groove of the groove panel can thus be located at a distance from the rear surface of the panel resting on the supporting structure. Moreover, the strip, which in the invention extends throughout substantially the entire length of the joint [35] edge of the strip panel, should be considered to encompass both the case where the strip is a continuous, uninterrupted element, and the case where the "strip" consists in its longitudinal direction of several parts, together covering the main portion of the joint edge.

[40] It should also be noted (i) that it is the first and the second mechanical connection as such that permit mutual displacement of the panels in the direction of the joint edges, and that (ii) it is the second mechanical connection as such that permits the locking element to leave the locking groove if [45] the groove panel is turned about its joint edge angularly away from the strip. Within the scope of the invention, there may thus exist means, such as glue and mechanical devices, that can counteract or prevent such displacement and/or upward angling.

[50] The system according to the invention makes it possible to provide concealed, precise locking of both the short and long sides of the panels in hard, thin floors. The floor panels can be quickly and conveniently disassembled in the reverse order of laying without any risk of damage to the panels, [55] ensuring at the same time a high laying quality.

The panels can be assembled and disassembled much faster than in present-day systems, and any damaged or worn-out panels can be replaced by taking up and re-laying parts of the floor.

According to an especially preferred embodiment of the [60] invention, a system is provided which permits precise joining of thin floor panels having, for example, a thickness of the order of 3 mm and which at the same time provides a tolerance-independent smooth top face at the joint. To this end, the strip is mounted in an equalising groove which is [65] countersunk in the rear side of the strip panel and which exhibits an exact, predetermined distance from its bottom to the front side of the strip panel. The part of the strip

[5]

projecting behind the groove panel engages a corresponding equalising groove, which is countersunk in the rear side of the groove panel and which exhibits the same exact, predetermined distance from its bottom to the front side of the groove panel. The thickness of the strip when is at least so [5] great that the rear side of the strip is flush with, and preferably projects slightly below the rear side of the panels. In this embodiment, the panels will always rest, in the joint, with their equalising grooves on a strip. This levels out the tolerance and imparts the necessary strength to the joint. The [10] strip transmits horizontal and upwardly-directed forces to the panels and downwardly-directed forces to the existing subfloor.

Preferably, the strip may consist of a material which is flexible, resilient and strong, and can be sawn. A preferred [15] strip material is sheet aluminium. In an aluminium strip, sufficient strength can be achieved with a strip thickness of the order of 0.5 mm.

In order to permit raking up previously laid, joined floor panels in a simple way, a preferred embodiment of the [20] invention is characterised in that when the groove panel is pressed against the strip panel in the second direction and is turned anglularly away from the strip, the maximum distance between the axis of rotation of the groove panel and the locking surface of the locking groove closest to the joint [25] edges is such that the locking element can leave the locking groove without contacting the locking surface of the locking groove. Such a disassembly can be achieved even if the aforementioned play between the locking groove and the locking surface is not greater than 0.2 mm. [30]

According to the invention, the locking surface of the locking element is able to provide a sufficient locking function even with very small heights of the locking surface. Efficient locking of 3-mm floor panels can be achieved with a locking surface that is as low as 2 mm. Even a 0.5-mm- [35] high locking surface may provide sufficient locking. The term "locking surface" as used herein relates to the part of the locking element engaging the locking groove to form the second mechanical connection.

For optimal function of the invention, the strip and the [40] locking element should be formed on the strip panel with high precision. Especially, the locking surface of the locking element should be located at an exact distance from the joint edge of the strip panel.

Furthermore, the extent of the engagement in the floor [45] panels should be minimised, since it reduces the floor strength.

By known manufacturing methods, it is possible to produce a strip with a locking pin, for example by extruding aluminium or plastics into a suitable section, which is [50] thereafter glued to the floor panel or is inserted in special grooves. These and all other traditional methods do however not ensure optimum function and an optimum level of

economy. To produce the joint system according to the invention, the strip is suitably formed from sheet aluminium, [55] and is mechanically fixed to the strip panel.

The laying of the panels can be performed by first placing the strip panel on the subfloor and then moving the groove panel with its long side up to the long side of the strip panel, at an angle between the principal plane of the groove panel [60] and the subfloor. When the joint edges have been brought into engagement with each other to form the first mechanical connection, the groove panel is angled down so as to accommodate the locking element in the locking groove.

Laying can also be performed by first placing both the [65] strip panel and the groove panel flat on the subfloor and then joining the panels parallel to their principal planes while

[6]

bending the strip downwards until the locking element snaps up into the locking groove. This laying technique enables in particular mechanical locking of both the short and long sides of the floor panels. For example, the long sides can be [5] joined together by using the first laying technique with downward angling of the groove panel, while the short sides are subsequently joined together by displacing the groove panel in its longitudinal direction until its short side is pressed on and locked to the short side of an adjacent panel [10] in the same row.

In connection with their manufacture, the floor panels can be provided with an underlay of e.g. floor board, foam or felt. The underlay should preferably cover the strip such that the joint between the underlays is offset in relation to the [15] joint between the floor panels.

The above and other features and advantages of the invention will appear from the appended claims and the following description of embodiments of the invention.

The invention will now be described in more detail [20] hereinbelow with reference to the accompanying drawing Figures.

DESCRIPTION OF DRAWING FIGURES

FIGS. **1*a*** and **1*b*** schematically show in two stages how [25] two floor panels of different thickness are joined together in floating fashion according to a first embodiment of the invention.

FIGS. **2*a-c*** show in three stages a method for mechanically joining two floor panels according to a second embodi-[30] ment of the invention.

FIGS. **3*a-c*** show in three stages another method for mechanically joining the floor panels of FIGS. **2*a-c***.

FIGS. **4*a*** and **4*b*** show a floor panel according to FIGS. **2*a-c*** as seen from below and from above, respectively.

[35] FIG. **5** illustrates in perspective a method for laying and joining floor panels according to a third embodiment of the invention.

FIG. **6** shows in perspective and from below a first variant [40] for mounting a strip on a floor panel.

FIG. **7** shows in section a second variant for mounting a strip on a floor panel.

DESCRIPTION OF PREFERRED [45] EMBODIMENTS

FIGS. **1*a*** and **1*b***, to which reference is now made, illustrate a first floor panel **1**, hereinafter termed strip panel, and a second floor panel **2**, hereinafter termed groove panel. The terms "strip panel" and "groove panel" are merely [50] intended to facilitate the description of the invention, the panels **1**, **2** normally being identical in practice. The panels **1** and **2** may be made from compact laminate and may have a

thickness of about 3 mm with a thickness tolerance of about ±0.2 mm. Considering this thickness tolerance, the [55] panels **1**, **2** are illustrated with different thicknesses (FIG. **1***b*), the strip panel 1 having a maximum thickness (3.2 mm) and the groove panel **2** having a minimum thickness (2.8 mm).

To enable mechanical joining of the panels **1**, **2** at [60] opposing joint edges, generally designated **3** and **4**, respectively, the panels are provided with grooves and strips as described in the following.

Reference is now made primarily to FIGS. **1***a* and **1***b*, and secondly to FIGS. **4***a* and **4***b* showing the basic design of the [65] floor panels from below and from above, respectively.

From the joint edge **3** of the strip panel **1**, i.e. the one long side, projects horizontally a flat strip **6** mounted at the

[7]

factory on the underside of the strip panel **1** and extending throughout the entire joint edge **3**. The strip **6**, which is made of flexible, resilient sheet aluminium, can be fixed mechanically, by means of glue or in any other suitable way. In FIGS. **1***a* and **1***b*, the strip **6** is glued, while in FIGS. **4***a* [5] and **4***b* it is mounted by means of a mechanical connection, which will be described in more detail hereinbelow.

Other strip materials can be used, such as sheets of other metals, as well as aluminium or plastics sections. Alternatively, the strip **6** may be integrally formed with the [10] strip panel **1**. At any rate, the strip **6** should be integrated with the strip panel **1**, i.e. it should not be mounted on the strip panel **1** in connection with laying. As a non-restrictive example, the strip **6** may have a width of about 30 mm and a thickness of about 0.5 mm.[15]

As appears from FIGS. **4***a* and **4***b*, a similar, although shorter strip **6'** is provided also at one short side **3'** of the strip pane **1**. The shorter strip **6'** does however not extend

throughout the entire short side **3'** but is otherwise identical with the strip **6** and, therefore, is not described in more detail here.[20]

The edge of the strip **6** facing away from the joint edge **3** is formed with a locking element **8** extended throughout the entire strip **6**. The locking element **8** has a locking surface **10** facing the joint edge **3** and having a height of e.g. 0.5 mm. The locking element **8** is so designed that when the floor is [25] being laid and the strip panel **2** of FIG. **1*a*** is pressed with its joint edge **4** against the joint edge **3** of the strip panel **1** and is angled down against the subfloor **12** according to FIG. **1*b***, it enters a locking groove **14** formed in the underside **16** of the groove panel **2** and extending parallel to and spaced from [30] the joint edge **4**. In FIG. **1*b***, the locking element **8** and the locking groove **14** together form a mechanical connection locking the panels **1**, **2** to each other in the direction designated D2. More specifically, the locking surface **10** of [35] the locking element **8** serves as a stop with respect to the surface of the locking groove **14** closest to the joint edge **4**.

When the panels **1** and **2** are joined together, they can however occupy such a relative position in the direction D2 that there is a small play Δ between the locking surface **10** [40] and the locking groove **14**. This mechanical connection in the direction D2 allows mutual displacement of the panels **1**, **2** in the direction of the joint, which considerably facilitates the laying and enables joining together the short sides by snap action.[45]

As appears from FIGS. **4*a*** and **4*b***, each panel in the system has a strip **6** at one long side **3** and a locking groove **14** at the other long side **4**, as well as a strip **6'** at one short side **3'** and a locking groove **14'** at the other short side **4'**.

Furthermore, the joint edge **3** of the strip panel **1** has in its [50] underside **18** a recess **20** extending throughout the entire joint edge **3** and forming together with the upper face **22** of

the strip **6** a laterally open recess **24**. The joint edge **4** of the groove panel **2** has in its top side **26** a corresponding recess **28** forming a locking tongue **30** to be accommodated in the [55] recess **24** so as to form a mechanical connection locking the joint edges **3**, **4** to each other in the direction designated D1. This connection can be achieved with other designs of the joint edges **3**, **4**, for example by a bevel thereof such that the joint edge **4** of the groove panel **2** passes obliquely in [60] underneath the joint edge **3** of the strip panel **1** to be locked between that edge and the strip **6**.

The panels **1**, **2** can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again.[65]

The strip **6** is mounted in a tolerance-equalising groove **40** in the underside **18** of the strip panel **1** adjacent the joint

[8]

edge **3**. In this embodiment, the width of the equalising groove **40** is approximately equal to half the width of the strip **6**, i.e. about 15 mm. By means of the equalising groove **40**, it is ensured that there will always exist between the top [5] side **21** of the panel **1** and the bottom of the groove **40** an exact, predetermined distance E which is slightly smaller than the minimum thickness (2.8 mm) of the floor panels **1**, **2**. The groove panel **2** has a corresponding tolerance-equalising surface or groove **42** in the underside **16** of the [10] joint edge **4**. The distance between the equalising surface **42** and the top side **26** of the groove panel **2** is equal to the aforementioned exact distance E. Further, the thickness of the strip **6** is so chosen that the underside **44** of the strip is situated slightly below the undersides **18** and **16** of the floor [15] panels **1** and **2**, respectively. In this manner, the entire joint will rest on the strip **6**, and all vertical downwardly-directed forces will be efficiently transmitted to the subfloor **12** without any stresses

being exerted on the joint edges **3**, **4**. Thanks to the provision of the equalising grooves **40**, **42**, an [20] entirely even joint will be achieved on the top side, despite the thickness tolerances or the panels **1**, **2**, without having to perform any grinding or the like across the whole panels. Especially, this obviates the risk of damage to the bottom layer of the compact laminate, which might give rise to [25] bulging of the panels.

Reference is now made to the embodiment of FIGS. **2*a-c*** showing in a succession substantially the same laying method as in FIGS. **1*a*** and **1*b***. The embodiment of FIGS. **2*a-c*** primarily differs from the embodiment of FIGS. **1*a*** and [30] **1*b*** in that the strip **6** is mounted on the strip panel **1** by means of a mechanical connection instead of glue. To provide this mechanical connection, illustrated in more detail in FIG. **6**, a groove **50** is provided in the underside **18** of the strip panel **1** at a distance from the recess **24**. The groove **50** may be [35] formed either as a continuous groove extending throughout the entire length of the panel **1**, or as a number of separate grooves. The groove **50** defines, together with the recess **24**, a dovetail gripping edge **52**, the underside of which exhibits an exact equalising distance E to the top side **21** of the strip [40] panel **1**. The aluminium strip **6** has a number of punched and bent tongues **54**, as well as one or more lips **56** which are bent round opposite sides of the gripping edge **52** in clamping engagement therewith. This connection is shown in detail from below in the perspective view of FIG. **6**.

[45] Alternatively, a mechanical connection between the strip **6** and the strip panel **1** can be provided as illustrated in FIG. **7** showing in section a cut-away part of the strip panel **1** turned upside down. In FIG. **7**, the mechanical connection comprises a dovetail recess **58** in the underside **13** of the [50] strip panel **1**, as well as tongues/lips **60** punched and bent from the strip **6** and clamping against opposing inner sides of the recess **58**.

The embodiment of FIGS. **2*a-c*** is further characterised in that the locking element **3** of the strip **6** is designed as a [55] component bent from the aluminium sheet and having an operative locking surface **10** extending at right angles up from the front side **22** of the strip **6** through a height of e.g. 0.5 mm, and a rounded guide surface **34** facilitating the insertion of the locking element **8** into the locking groove **14** [60] when angling down the groove panel **2** towards the subfloor **12** (FIG. **2*b***), as well as a portion **36** which is inclined towards the subfloor **12** and which is not operative in the laying method illustrated in FIGS. **2a-c**.

Further, it can be seen from FIGS. **2*a-c*** that the joint edge [65] **3** of the strip panel **1** has a lower bevel **70** which cooperates during laying with a corresponding upper bevel **72** of the joint edge **4** of the groove panel **2**, such that the panels **1** and

[9]

2 are forced to move vertically towards each other when their joint edges **3**, **4** are moved up to each other and the panels are pressed together horizontally.

Preferably, the locking surface **10** is so located relative to the joint edge **3** that when the groove panel **2**, starting from [5] the joined position in FIG. **2*c***, is pressed horizontally in the direction D2 against the strip panel **1** and is turned angularly up from the strip **6**, the maximum distance between the axis of rotation A of the groove panel **2** and the locking surface **10** of the locking groove is such that the locking element **8** [10] can leave the locking groove **14** without coming into contact with it.

FIGS. **3*a*-3*b*** show another joining method for mechanically joining together the floor panels of FIGS. **2*a-c***. The method illustrated in FIGS. **3*a-c*** relies on the fact that the [15] strip **6** is resilient and is especially useful for joining

together the short sides of floor panels which have already been joined along one long side as illustrated in FIGS. **2*a-c***. The method of FIGS. **3*a-c*** is performed by first placing the two panels **1** and **2** flat on the subfloor **12** and then moving them [20] horizontally towards each other according to FIG. **3*b***. The inclined portion **36** of the locking element **8** then serves as a guide surface which guides the joint edge **4** of the groove panel **2** up on to the upper side **22** of the strip **6**. The strip **6** will then be urged downwards while the locking element [25] **8** is sliding on the equalising surface **42**. When the joint edges **3**, **4** have been brought into complete engagement with each other horizontally, the locking element **8** will snap into the locking groove **14** (FIG. **3*c***), thereby providing the same locking as in FIG. **2*c***. The same locking method can [30] also be used by placing, in the initial position, the joint edge **4** of the groove panel with the equalising groove **42** on the locking element **10** (FIG. **3*a***). The inclined portion **36** of the locking element **10** then is not operative. This technique thus makes it possible to lock the floor panels mechanically in all [35] directions, and by repeating the laying operations the whole floor can be laid without using any glue.

The invention is not restricted to the preferred embodiments described above and illustrated in the drawings, but several variants and modifications thereof are conceivable [40] within the scope of the appended claims. The strip **6** can be divided into small sections covering the major part of the joint length. Further, the thickness of the strip **6** may vary throughout its width. All strips, locking grooves, locking elements and recesses are so dimensioned as to enable [50] laying the floor panels with flat top sides in a manner to rest on the strip **6** in the joint. If the floor panels consist of compact laminate and if silicone or any other sealing compound, a rubber strip or any other sealing device is applied prior to laying between the flat projecting part of the

strip **6** and the groove panel **2** and/or in the recess **26**, a moisture-proof floor is obtained.

As appears from FIG. **6**, an underlay **46**, e.g. of floor board, foam or felt, can be mounted on the underside of the [55] panels during the manufacture thereof. In one embodiment, the underlay **46** covers the strip **6** up to the locking element **8**, such that the joint between the underlays **46** becomes offset in relation to the joint between the joint edges **3** and **4**.[60]

In the embodiment of FIG. **5**, the strip **6** and its locking element **8** are integrally formed with the strip panel **1**, the projecting part of the strip **6** thus forming an extension of the lower part of the joint edge **3**. The locking function is the same as in the embodiments described above. On he under-[65] side **18** of the strip panel **1**, there is provided a separate strip, band or the like **74** extending throughout the entire length of

[10]

the joint and having, in this embodiment, a width covering approximately the same surface as the separate strip **6** of the previous embodiments. The strip **74** can be provided directly on the rear side **18** or in a recess formed therein (not shown), [5] so that the distance from the front side **21**, **26** of the floor to the rear side **76**, including the thickness of the strip **74**, always is at least equal to the corresponding distance in the panel having the greatest thickness tolerance. The panels **1**, **2** will then rest, in the joint, on the strip **74** or only on the [10] undersides **18**, **16** of the panels, if these sides are made plane.

When using a material which does not permit downward bending of the strip **6** or the locking element **8**, laying can be performed in the way shown in FIG. **5**. A floor panel **2*a*** [15] is moved angled upwardly with its long side **4*a*** into engagement with the long side **3** of a previously laid floor

panel **1** while at the same time a third floor panel **2*b*** is moved with its short side **4*b***' into engagement with the short side **3*a***' of the upwardly-angled floor panel **2*a*** and is fastened by [20] angling the panel **2*b*** downwards. The panel **2*b*** is then pushed along the short side **3*a***' of the upwardly-angled floor panel ***2a*** until its long side **4*b*** encounters the long side **3** of the initially-laid panel **1**. The two upwardly-angled panels **2*a*** and **2*b*** are therefore angled down on to the subfloor **12** [25] so as to bring about locking.

By a reverse procedure the panels can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again.

Several variants of preferred laying methods are conceiv-[30]able. For example, the strip panel can be inserted under the groove panel, thus enabling the laying of panels in all four directions with respect to the initial position.

What is claimed is:

1. An edge lock for use in a flooring system having a [35] plurality of floor panels, the edge lock for mechanically and releasably locking together adjacent edges of pairs of adjacent floor panels during assembly of the flooring system and when said adjacent floor panels are laying flat on a subfloor with upper corner portions of said adjacent edges being [40] mutually spaced apart, said edge lock comprising:

locking means for forming a first mechanical connection for locking said adjacent edges to each other in a vertical direction, and for forming a second mechanical [45] connection for locking said adjacent edges to each other in a horizontal direction at right angles to said edges, said locking means including:

(i) a locking groove extending parallel to and spaced from a first one of the adjacent edges of one of the [50] adjacent floor panels and being open at

a rear side of said one adjacent floor panel, and

(ii) a flexible and resilient locking strip integrated with another of the adjacent floor panels, said locking strip extending throughout substantially an entire [55] length of an edge of the another adjacent floor panel, said locking strip being provided with a locking element projecting from the locking strip,

said locking means being constructed so as to operate as a one-way snap lock in said horizontal direction during [60] the assembly of said flooring system when displacing said adjacent edges towards each other by resiliently urging the flexible locking strip downwards until the upper corner portions of said adjacent edges have been brought into complete engagement with each other and [65] the locking element thereby snaps into the locking groove to prevent drifting apart of said adjacent edges, and

[11]

said locking means also being constructed so as to enable said adjacent panels, while they are mechanically connected to each other by said first and second mechanical connections, to be turned in relation to each other about said upper corner portions of their locked- [50] together edges in an angular direction so as to move the locking element out of the locking groove in order to unlock said one-way snap lock.

2. The edge lock as claimed in claim 1, wherein said first mechanical connection is a tongue-and-groove connection, [10] including a tongue and a tongue groove for receiving said tongue.

3. The edge lock as claimed in claim 2, wherein said tongue groove is limited upwardly by an upper lip which is formed in one piece with its corresponding panel and [15] wherein said tongue is made in one piece with its corresponding panel.

4. The edge lock as claimed in claim 2, wherein said tongue groove is limited downwardly by a lower lip which is formed in one piece with its corresponding panel and [20] which defines said locking strip.

5. The edge lock as claimed in claim 4, wherein a thickness of said locking strip varies in its width direction.

6. The edge lock as claimed claim 2, wherein said adjacent edges being provided with co-operating lower and [25] upper bevels, said lower bevel being formed at a tip of an upper lip which limits said tongue groove upwardly, and said upper bevel being formed in a tip of said tongue.

7. The edge lock as claimed in claim 2, wherein a tip of said tongue presents a lower surface portion which is [30] nonparallel to an adjacent surface portion of the tongue groove located underneath said lower surface portion.

8. The edge lock as claimed in claim 1, wherein said locking strip is integrally formed with said another panel, i.e., made in one piece therewith.[35]

9. The edge lock as claimed in claim 8, wherein a thickness of said locking strip varies in its width direction.

10. The edge lock as claimed in claim 1, wherein said locking strip is made of a material different from that of said another floor panel and is fixedly mounted on said another [40] panel at the factory.

11. The edge lock as claimed in claim **1**, wherein said adjacent edges being provided with co-operating lower and upper bevels.

12. The edge lock as claimed in claim **1**, wherein the [45] locking element consists of a locking edge extending continuously along the locking strip.

13. A short-edge lock for use in a flooring system having a plurality of rectangular floor panels arranged in parallel panel rows, the short-edge lock for mechanically and releas- [50] ably locking together adjacent short edges of pairs of adjacent floor panels in a new row during assembly of the flooring system when said adjacent floor panels are already mechanically joined to a common long edge of a floor panel in an adjacent panel row and are laying flat on a subfloor [55] with upper corner portions of said adjacent short edges being mutually spaced apart, said short-edge lock comprising:

locking means for forming a first mechanical connection for locking said adjacent short edges to each other in a vertical direction, and for forming a second mechanical [60] connection for locking said adjacent short edges to each other in a horizontal direction at right angles to said short edges, said locking means including:

(i) a locking groove extending parallel to and spaced from a first one of the adjacent short edges of one of [65] the adjacent floor panels and being open at the rear side of said one adjacent floor panel, and

(ii) a flexible and resilient locking strip integrated with another of the adjacent floor panels, said locking strip

extending throughout substantially an entire length of a short edge of the another adjacent floor [5] panel, said locking strip being provided with a locking element projecting from the locking strip,

said locking means being constructed so as to operate as a one-way snap lock in said horizontal direction during the assembly of said flooring system when displacing [10] said adjacent short edges towards each other by resiliently urging the flexible locking strip downwards until upper corner portions of said adjacent short edges have been brought into complete engagement with each other and the locking element thereby snaps into the [15] locking groove for preventing drifting apart of said adjacent short edges.

14. The short-edge lock as claimed in claim **13**, wherein said locking means being constructed so as to enable said adjacent panels, while they are mechanically connected to[20] each other by said first and second mechanical connections, to be turned in relation to each other about said upper corner portions of their locked-together short edges in an angular direction so as to move the locking element out of the locking groove in order to unlock said one-way snap lock.

[25] **15**. The short-edge lock as claimed in claim **13**, wherein said first mechanical connection is a tongue-and-groove connection, including a tongue and a tongue groove for receiving said tongue.

16. The short-edge lock as claimed in claim **15**, wherein [30] said tongue groove is limited upwardly by an upper lip which is formed in one piece with its corresponding panel and wherein said tongue is made in one piece with its corresponding panel.

17. The short-edge lock as claimed in claim **15**, wherein [35] said tongue groove is limited downwardly by a lower lip which is formed in one piece with its corresponding panel and which defines said locking strip.

18. The short-edge lock as claimed in claim **17**, wherein a thickness of said locking strip varies in its width direction.

[40] **19**. The short-edge lock as claimed claim **15**, wherein said adjacent short edges being provided with co-operating lower and upper bevels, said lower bevel being formed at a tip of an upper lip which limits said tongue groove upwardly, and said upper bevel being formed in a tip of said tongue.

[45] **20**. The short-edge lock as claimed in claim **15**, wherein a tip of said tongue presents a lower surface portion which is nonparallel to an adjacent surface portion of the tongue groove located underneath said lower surface portion.

21. The short-edge lock as claimed in claim 13, wherein [50] said locking strip is integrally formed with said another panel, i.e., made in one piece therewith.

22. The short-edge lock as claimed in claim **21**, wherein a thickness of said locking strip varies in its width direction.

23. The short-edge lock as claimed in claim **13**, wherein [55] said locking strip is made of a material different from that of said another floor panel and is fixedly mounted on said another floor panel at the factory.

24. The short-edge lock as claimed in claim **13**, wherein said adjacent short edges being provided with co-operating [60] lower and upper bevels.

25. The short-edge lock as claimed in claim **13**, wherein the locking element consists of a locking edge extending continuously along the locking strip.

26. An edge lock for use in a flooring system having a [65] plurality of floor panels arranged in parallel panel rows and having pairs of opposite first edges and pairs of opposite second edges, the edge lock for mechanically and releasably

[13]

locking together adjacent first edges of pairs of adjacent floor panels in a new row during assembly of the flooring system when said adjacent floor panels are already mechanically joined to a common second edge of a floor panel in an adjacent panel row and are laying flat on a subfloor with [5] upper corner portions of said adjacent first edges being mutually spaced apart, said edge lock comprising:

locking means for forming a first mechanical connection for locking said adjacent first edges to each other in a vertical direction, and for forming a second mechanical [10] connection for locking said adjacent short edges to each other in a horizontal direction at right angles to said first edges, said locking means including:

(i) a locking groove extending parallel to and spaced from a first one of [15] the adjacent first edges of one of the adjacent floor panels and being open at the rear side of said one adjacent floor panel, and

(ii) a flexible and resilient locking strip integrated with another of the adjacent floor panels, said locking strip extending throughout substantially an entire [20] length of a first edge of the another adjacent floor panel, said locking strip being provided with a locking element projecting from the locking strip,

said locking means being constructed so as to operate as a one-way snap lock in said horizontal direction during the assembly of said flooring system when displacing [25] said adjacent first edges towards each other by resiliently urging the flexible

locking strip downwards until upper corner portions of said adjacent first edges have been brought into complete engagement with each other and the locking element thereby snaps into [30] the locking groove for preventing drifting apart of said adjacent first edges.

27. The edge lock as claimed in claim **26**, wherein said locking means being constructed so as to enable said adjacent panels, while they are mechanically connected to each [35] other by said first and second mechanical connections, to be turned in relation to each other about said upper corner portions of their locked-together first edges in an angular direction so as to move the locking element out of the locking groove in order to unlock said one-way snap lock.[40]

28. The edge lock as claimed in claim **26**, wherein said first mechanical connection is a tongue-and-groove connection, including a tongue and a tongue groove for receiving said tongue.

29. The edge lock as claimed in claim **28**, wherein said [45] tongue groove is limited upwardly by an upper lip which is formed in one piece with its corresponding panel and wherein said tongue is made in one piece with its corresponding panel.

30. The edge lock as claimed in claim **28**, wherein said [50] tongue groove is limited downwardly by a lower lip which is formed in one piece with its corresponding panel and which defines said locking strip.

31. The edge lock as claimed in claim **30**, wherein a thickness of said locking strip varies in its width direction.[55]

32. The edge lock as claimed claim **28**, wherein said adjacent first edges being provided with co-operating lower and upper bevels, said lower bevel being formed at a tip of an upper lip which limits said tongue groove upwardly, and said upper bevel being formed in a tip of said tongue.[60]

33. The edge lock as claimed in claim **28**, wherein a tip of said tongue presents a lower surface portion which is nonparallel to an adjacent surface portion of the tongue groove located underneath said lower surface portion.

34. The edge lock as claimed in claim **26**, wherein said [65] locking strip is integrally formed with said another panel, i.e., made in one piece therewith.

[14]

35. The edge lock as claimed in claim **34**, wherein a thickness of said locking strip varies in its width direction.

36. The edge lock as claimed in claim **26**, wherein said flexible and resilient locking strip integrated with said [5] another floor panel is made of a material different from that of said another floor panel and is fixedly mounted on said another panel at the factory.

37. The edge lock as claimed in claim **26**, wherein said adjacent edges being provided with co-operating lower and [10] upper bevels.

38. The edge lock as claimed in claim **26**, wherein the locking element consists of a locking edge extending continuously along the locking strip.

39. A flooring system comprising a plurality of rectangular floor panels which are mechanically connectable to each [15] other in parallel rows along adjacent long edges and short edges, respectively, of the panels, said floor panels being provided with means for mechanically locking together their long edges as well as their short edges in a first direction at right angles to a principal plane of the panels, thereby [20] forming first mechanical connections between the panels,

each panel, at a rear side thereof, being provided:

(i) with a locking strip at one long edge and at one short edge, each locking strip extending throughout substantially

an entire length of the corresponding edge [25] of the panel and being provided with a projecting locking element, and

(ii) with a locking groove at an opposite long edge and at an opposite short edge, each locking groove extending parallel to and spaced from the corre- [30] sponding edge and being open at the rear side of the panel, said locking strips and locking grooves forming second mechanical connections locking the panels to each other in a second direction parallel to the principal plane and at right angles to the joint edges [35] such that a locking strip of a first one of two joined panels projects on the rear side of the second panel with its locking element received in the locking groove of the second panel,

the first and the second mechanical connections are so [40]constructed as to allow mutual displacement of the panels in the direction of the long edges,

the second mechanical connection along the long edges is so constructed as to allow the locking element to leave the locking groove if the panel associated with the [45] locking groove is turned about its long edge angularly away from the strip, and

each locking strip at the short edges is flexible and resilient such that two of the floor panels, having already been mechanically joined to a common long [50] edge of a third of the floor panels, can be mechanically joined together at their adjacent short edges by displacing said two panels

horizontally towards each other, while resiliently urging the flexible strip at one of said short edges downwards, until said adjacent short edges [55] of the two panels have been brought into complete engagement with each other horizontally and the locking clement at said one short edge thereby snaps into the locking groove at the adjacent short edge.

40. The flooring system as claimed in claim **39**, wherein [60] the first mechanical connection as well as the second mechanical connection along the long edges are such that they allow the locking element to enter the locking groove if the panel associated with the groove is turned about its joint edge angularly towards the strip while holding the [65] upper part of the joint edge of the panel associated with the groove in contact with the upper part of the joint edge of the adjacent panel associated with the strip.

[15]

41. The flooring system as claimed in claim **39**, wherein the first mechanical connection as well as the second mechanical connection along the long edges are such that they allow the locking element to leave the locking groove if the panel associated with the groove is turned about its [5] joint edge angularly away from the strip while holding the upper part of the joint edge of the panel associated with the groove in contact with the upper part of the joint edge of the adjacent panel associated with the strip.

42. The flooring system as claimed in claim **39**, wherein [10] in order to resiliently urge the flexible strip downwards while displacing said adjacent short edges horizontally towards each other, said adjacent short edges being provided with cooperating lower and upper bevels such that the panels are forced to move vertically towards each other when their

[15] adjacent short edges are moved up to each other and the panels are pressed together horizontally.

43. The flooring system as claimed in claim **39**, wherein a locking surface of the locking element is extended from a front side of the strip through a height in said first direction that is less than or equal to 2 mm. [20]

44. The flooring system as claimed in claim **39**, wherein the locking element comprises a locking edge extending continuously along the strip.

45. The flooring system as claimed in claim **39**, wherein an underlay of floor boards, foam, felt or the like, is fixed to [25] the rear sides of the panels.

46. The flooring system as claimed in claim **45**, wherein the underlay is fixed so as to cover the strip in said second direction at least up to the locking element such that a joint between the underlays of the two adjacent panels is offset in [30] said second direction relative to the joint edges.

47. The flooring system as claimed in claim **39**, wherein a sealing means, such as a sealing compound, a rubber strip, or the like, is provided on a front side of the strip between the locking element and the joint edge of the panel associ- [35] ated with the strip to seal against the other panel.

48. The flooring system as claimed in claim **39**, wherein each locking strip is integrally formed in one piece with the respective panel and forming an extension of a lower part of the corresponding edge of the respective panel.

49. The flooring system as claimed in claim **39**, wherein [40] the panels are constructed such that, when joined together along their long edges occupy a relative position in the second direction such that a play exists between the locking groove and a locking surface of the locking element that is facing the long edges, such that the second mechanical [45] connection allows mutual displacement of the panels in the direction of the long edges.

50. A flooring system, comprising a plurality of floor panels which are mechanically connectable to each other in parallel rows along adjacent first edges and second edges, [50] respectively, of the panels, said floor panels being provided with means for mechanically locking together their first edges as well as their second edges in a first direction at right angles to a principal plane of the panels, thereby forming first mechanical connections between the panels, wherein: [55]

each panel, at a rear side thereof, being provided:

(i) with a locking strip at one first edge and at one second edge, each locking strip extending throughout substantially an entire length of the corresponding first edge of the panel and being provided with a 6o projecting locking element, and

(ii) with a locking groove at an opposite first edge and at an opposite short edge, each locking groove extending parallel to and spaced from the corresponding edge and being open at the rear side of the panel, said locking strips and locking grooves form-

ing second mechanical connections locking the pan-eis to each other in a second direction parallel to the principal plane and at right angles to the joint edges, such that a strip of a first one of two joined panels [5] projects on the rear side of the second panel with its locking element received

in the locking groove of the second panel,

the first and the second mechanical connections are so constructed so as to allow mutual displacement of the [10] panels in the direction of the first edges,

the second mechanical connection along the first edge is so constructed as to allow the locking element to leave the locking groove if the panel associated with the locking groove is turned about its first edge angularly [15] away from the strip, and

each locking strip at the second edge is flexible and resilient such that two panels, having already been mechanically joined to a common first edge of a third panel, can be mechanically joined together at their [20] adjacent second edge by displacing said two panels horizontally towards each other, while resiliently urging the flexible strip at one of said second edges downwards, until said adjacent second edges of the two panels have been brought into complete engagement [25] with each other horizontally and the locking element at said one second edge thereby snaps into the locking groove at the adjacent second edge.

51. The flooring system as claimed in claim **50**, wherein said first mechanical connections include a tongue-and- [30] groove connection, including a tongue and a tongue groove for receiving said tongue.

52. The flooring system as claimed in claim **51**, wherein said tongue groove is limited upwardly by an upper lip which is formed in one piece with its corresponding panel [35] and wherein said tongue is made in one piece with its corresponding panel.

53. The flooring system as claimed in claim **51**, wherein said tongue groove is limited downwardly by a lower lip

which is formed in one piece with its corresponding panel and which defines said locking strip.

[40] **54.** The flooring system as claimed in claim **53**, wherein a thickness of said locking strip varies in its width direction.

55. The flooring system as claimed claim **51**, wherein said adjacent edges being provided with co-operating lower and upper bevels, said lower bevel being formed at a tip of an [45] upper lip which limits said tongue groove upwardly, and said upper bevel being formed in a tip of said tongue.

56. The flooring system as claimed in claim **51**, wherein a tip of said tongue presents a lower surface portion which is nonparallel to an adjacent surface portion of the tongue [50] groove located underneath said lower surface portion.

57. The flooring system as claimed in claim **50**, wherein said locking strip is integrally formed with said second panel, i.e., made in one piece therewith.

58. The flooring system as claimed in claim **57**, wherein [55] a thickness of said locking strip varies in its width direction.

59. The flooring system as claimed in claim **50**, wherein said locking strip is made of a material different from that of said second panel and is fixedly mounted on said another panel at the factory.

60. The flooring system as claimed in claim **50**, wherein [60] said adjacent edges being provided with co-operating lower and upper bevels.

61. The flooring system as claimed in claim **50**, wherein the locking element consists of a locking edge extending continuously along the locking strip.

* * * * *

APPENDIX H

UNITED STATES PATENT

Patent No. 5,706,621

See Fold Out Exhibits
Diagrams

US005706621A

United States Patent [19]

Pervan

[11] Patent Number: 5,706,621

[45] Date of Patent: Jan. 13, 1998

[54] **SYSTEM FOR JOINING BUILDING BOARDS**

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[73] Assignee: **Välinge Aluminum AB**, Viken, Sweden

[21] Appl. No.: **436,224**

[22] PCT Filed: **Apr. 29, 1994**

[86] PCT No.: **PCT/SE94/00386**

§ 371 Date: **May 17, 1995**

§ 102(e) Date: **May 17, 1995**

[87] PCT Pub. No.: **WO94/26999**

PCT Pub. Date: **Nov. 24, 1994**

[30] **Foreign Application Priority Data**

May 10, 1993 [SE] Sweden 9301595

[51] **Int. Cl.**[6] **E04F 15/22**

[52] **U.S. Cl.** **52/403.1**; 52/480; 52/506.05; 52/551

[58] **Field of Search** 52/480, 550, 551, 52/506.05, 403.1

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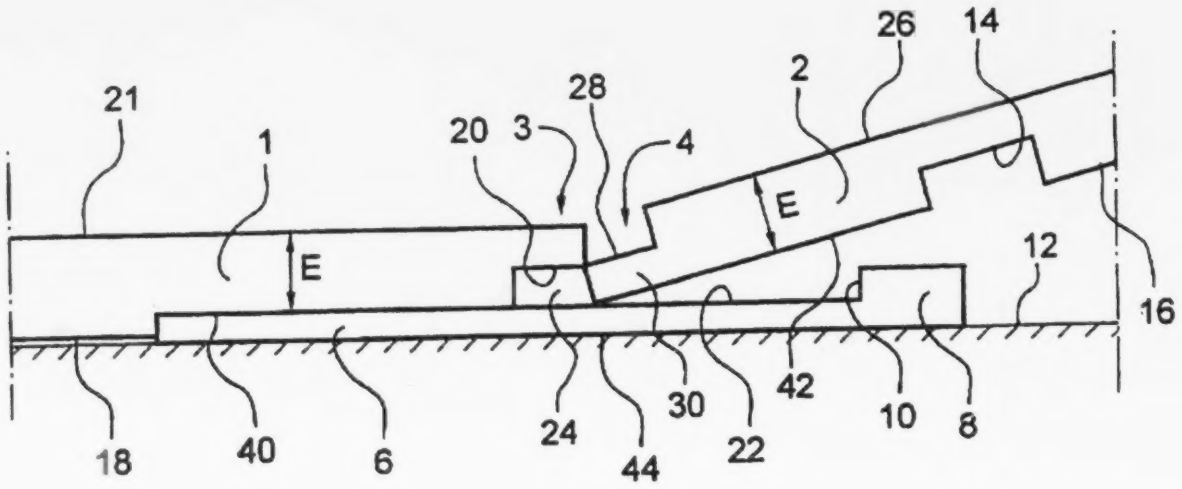
Primary Examiner—Carl D. Friedman
Assistant Examiner—Yvonne Horton-Richardson
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis, L.L.P.

[57] **ABSTRACT**

The invention relates to a system for laying and mechanically joining building panels, especially thin, hard, floating floors. Adjacent joint edges (3, 4) of two panels (1, 2) engage each other to provide a first mechanical connection locking the joint edges (3, 4) in a first direction (D1) perpendicular to the principal plane of the panels. In each joint, there is further provided a strip (6) which is integrated with one joint edge (3) and which projects behind the other joint edge (4). The strip (6) has an upwardly protruding locking element (8) engaging in a locking groove (14) in the rear side (16) of the other joint edge (4) to form a second mechanical connection locking the panels (1, 2) in a second direction (D2) parallel to the principal plane of the panels and at right angles to the joint. Both the first and the second mechanical connections allow mutual displacement of joined panels (1, 2) in the direction of the joint.

23 Claims, 6 Drawing Sheets



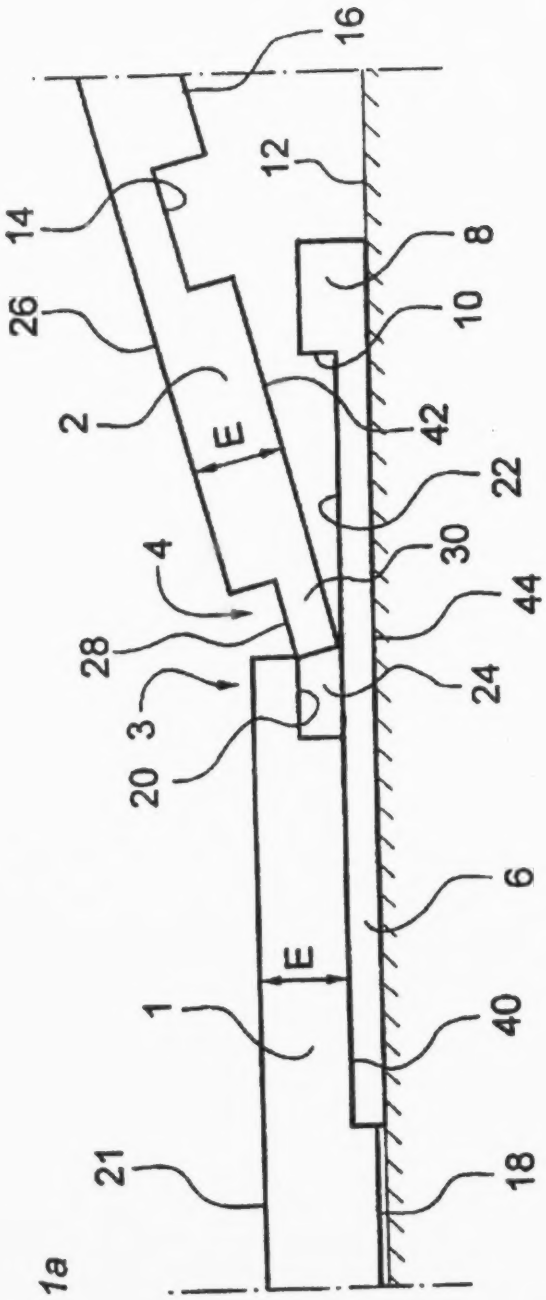

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Fig. 1a

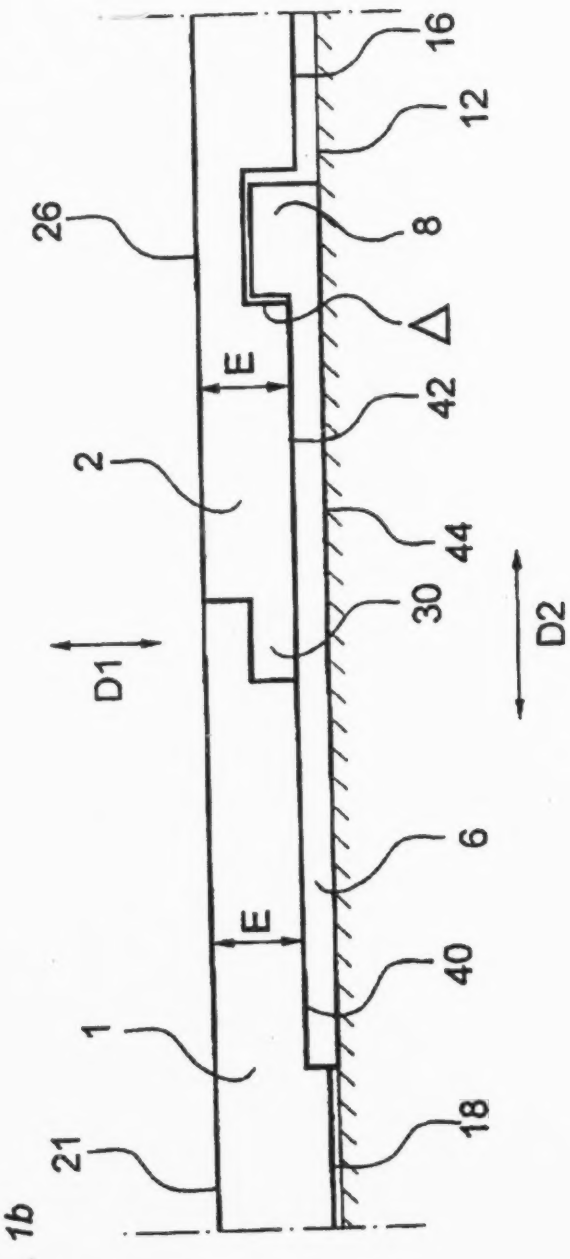
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Fig. 1b

Fig. 2a

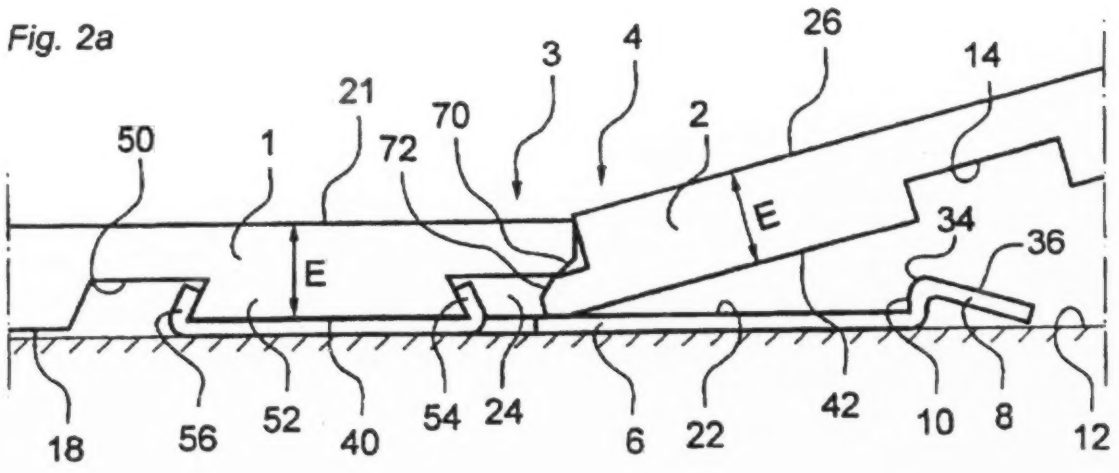


Fig. 2b

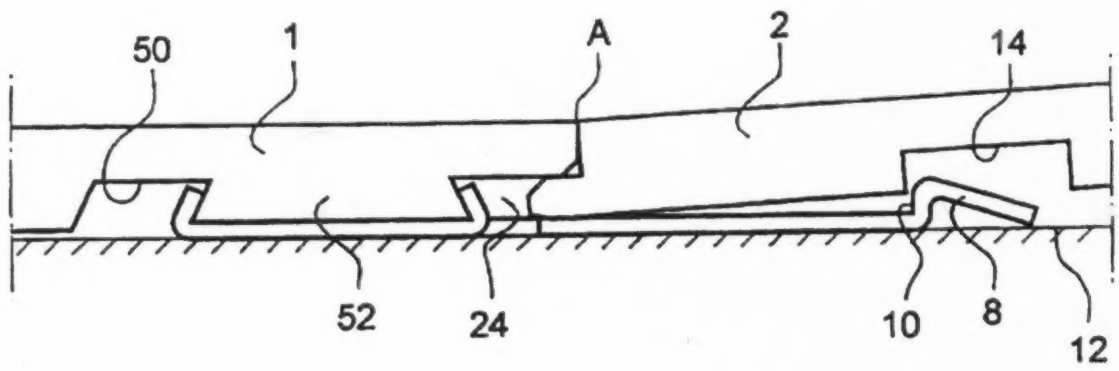


Fig. 2c

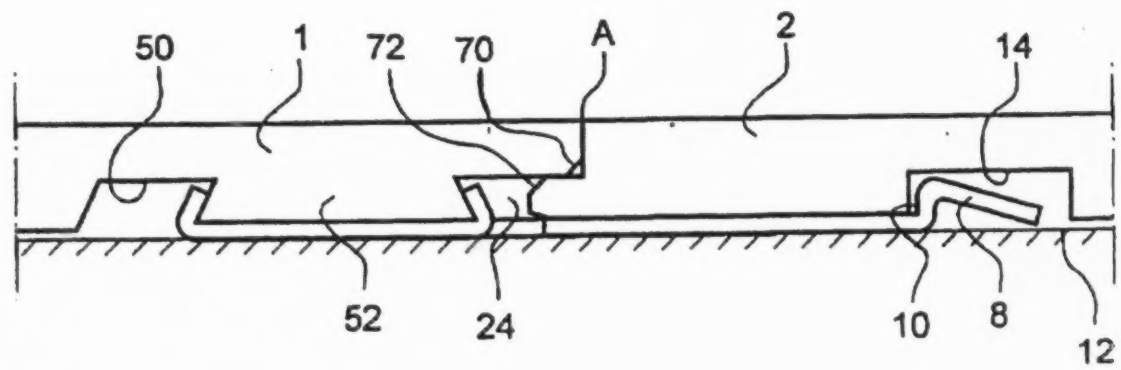


Fig. 3a

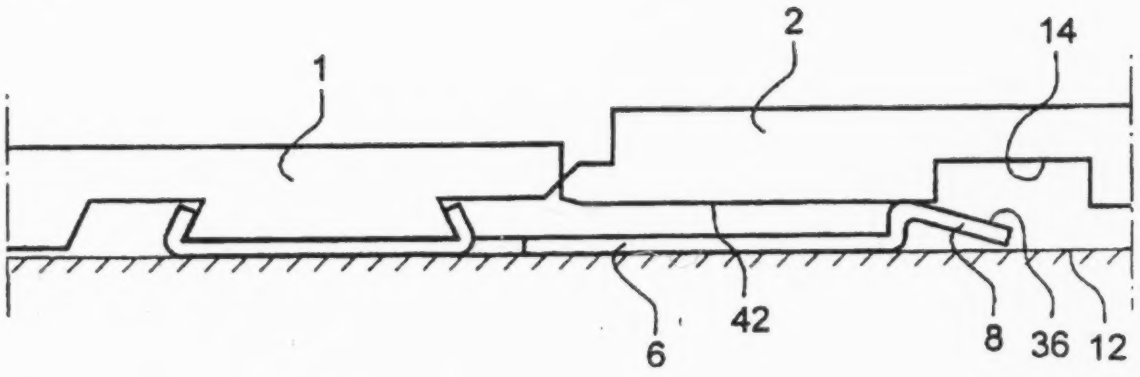


Fig. 3b

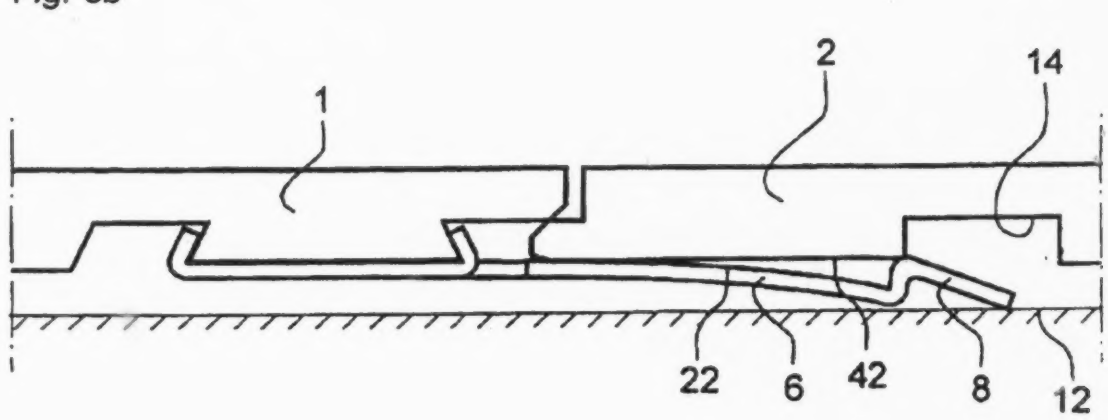


Fig. 3c

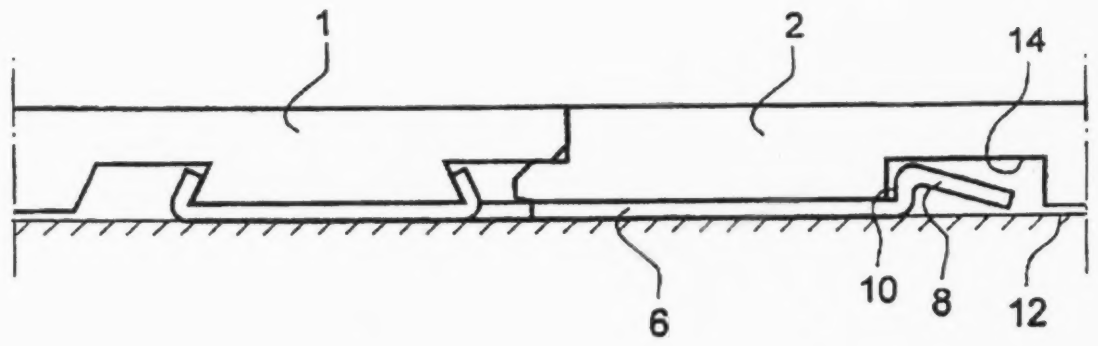


Fig. 4a

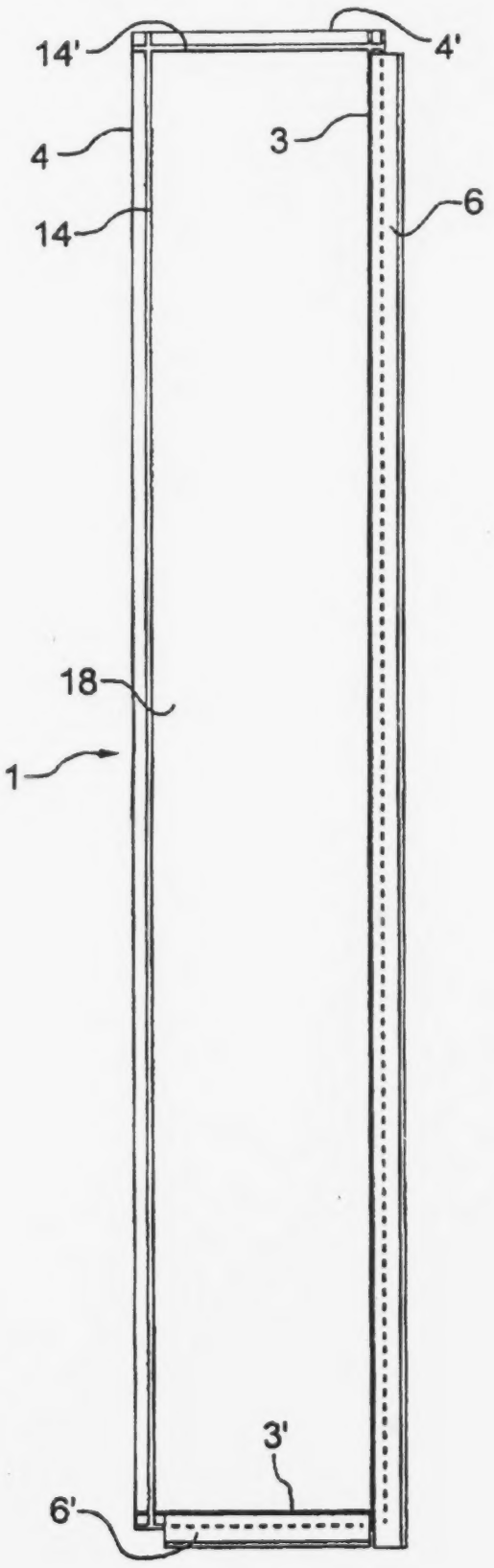
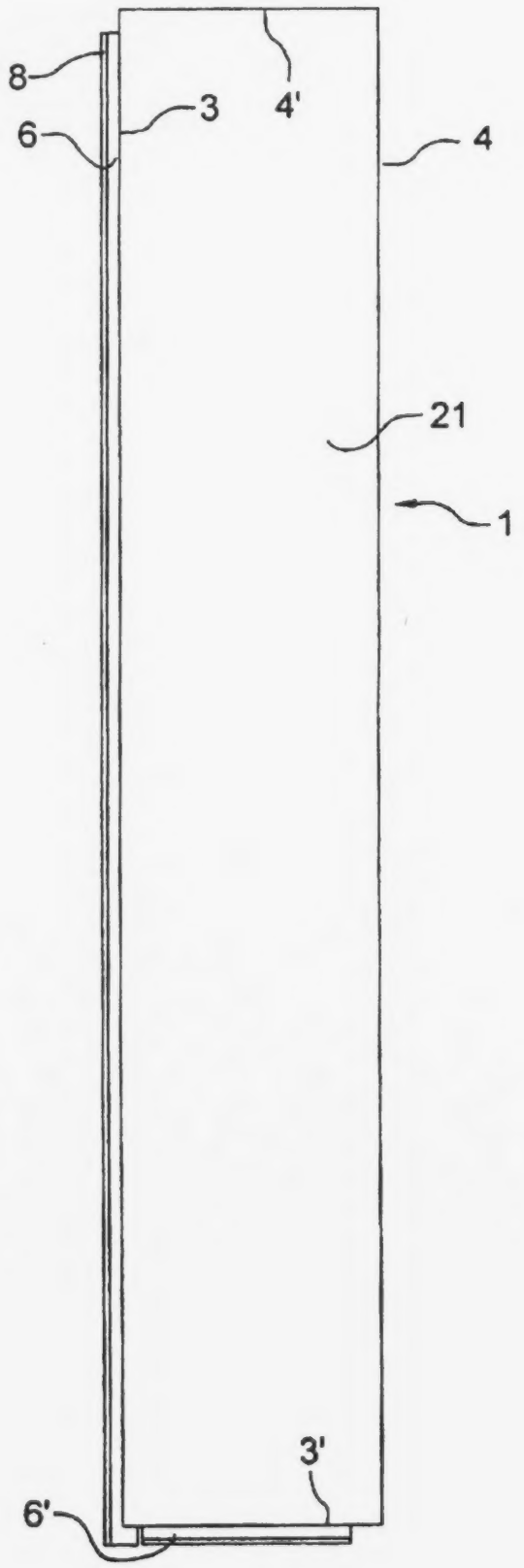


Fig. 4b



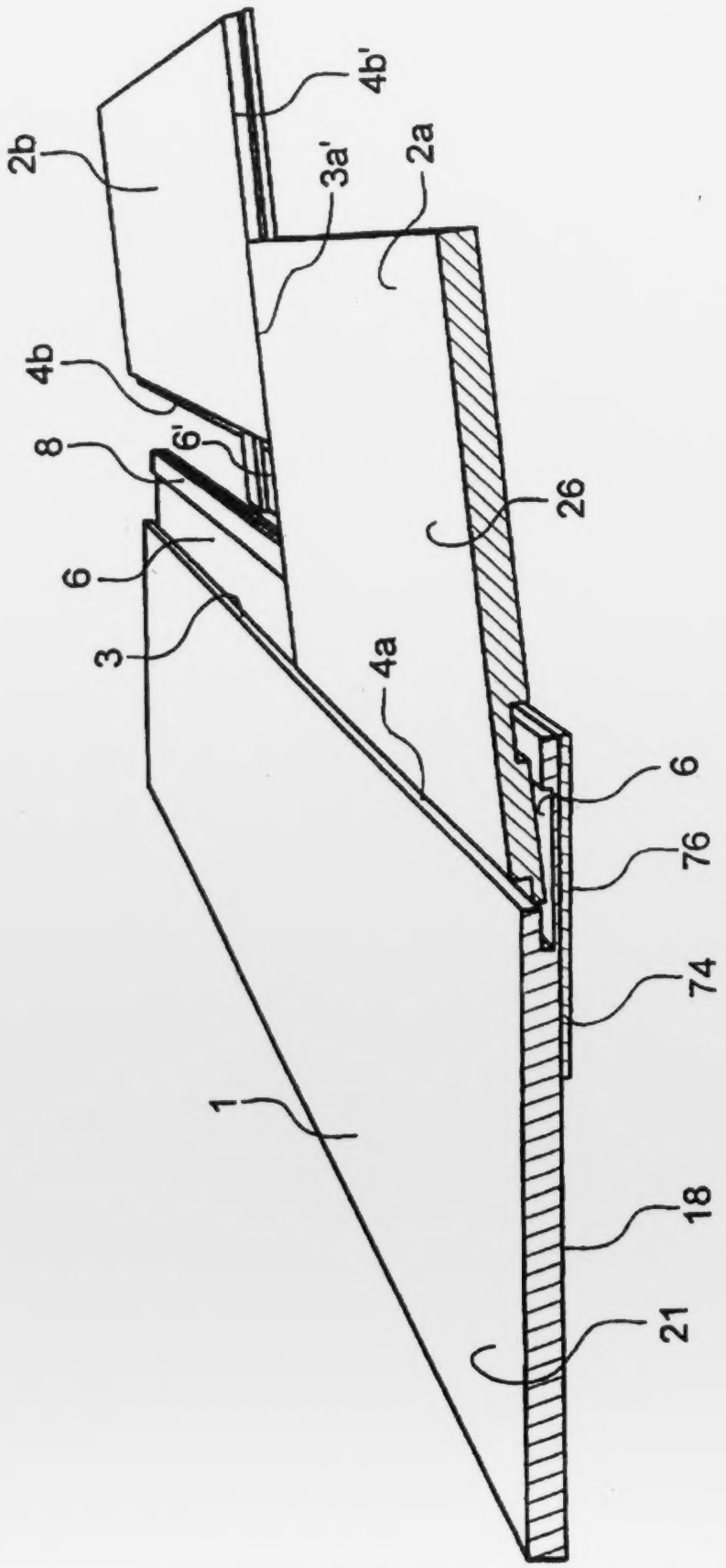


Fig. 5

Fig. 6

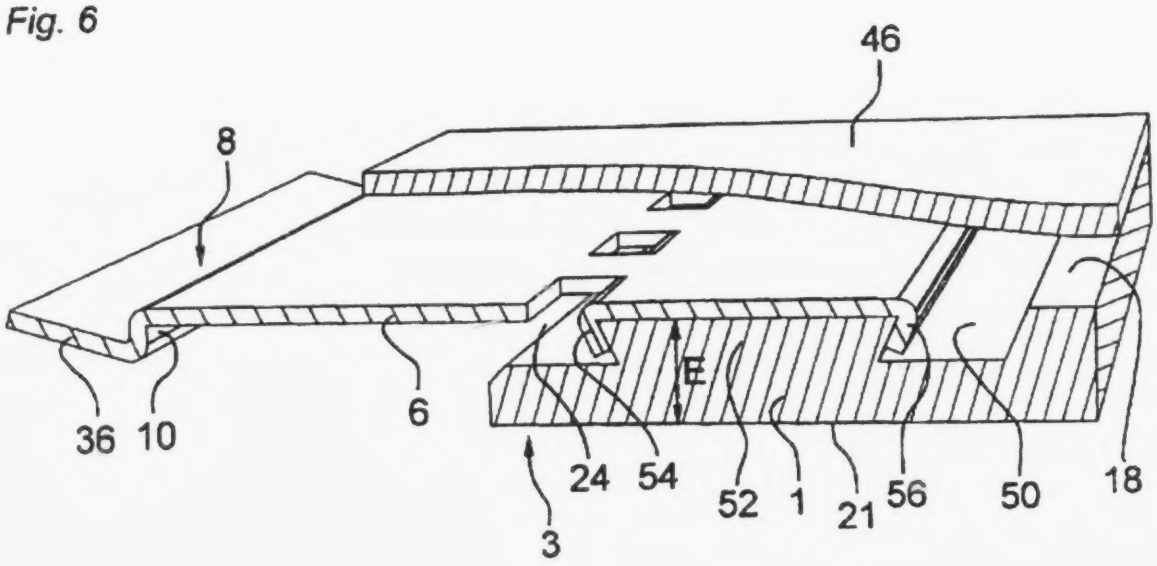
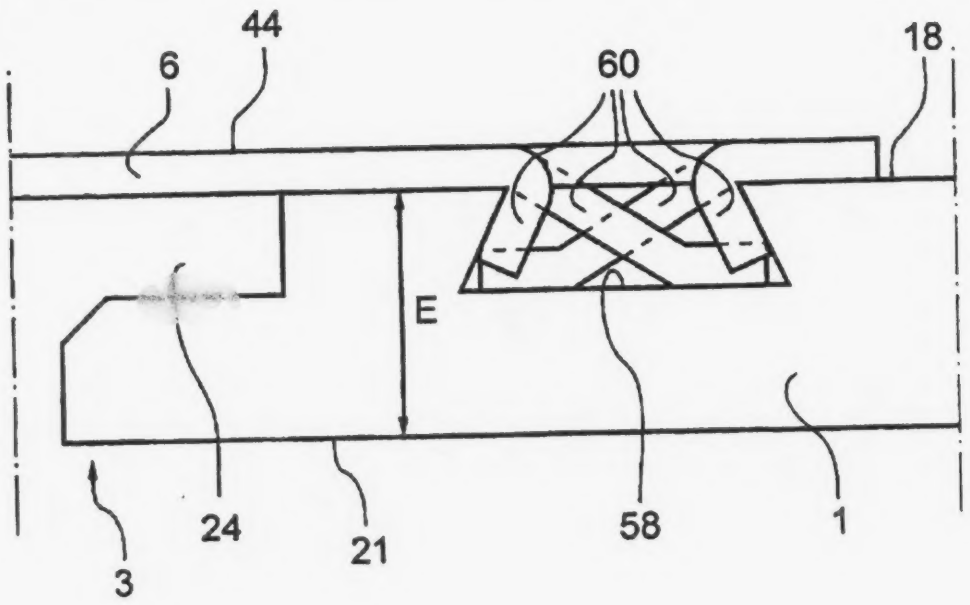


Fig. 7



[1]

SYSTEM FOR JOINING BUILDING BOARDS

TECHNICAL FIELD

The invention generally relates to a system for providing a joint along adjacent joint edges of two building panels,[5] especially floor panels.

More specifically, the joint is of the type where the adjacent joint edges together form a first mechanical connection locking the joint edges to each other in a first direction at fight angles to the principal plane of the panels,[10] and where a locking device forms a second mechanical connection locking the panels to each other in a second direction parallel to the principal plane and at right angles to the joint edges, the locking device comprising a locking groove which extends parallel to and spaced from the joint [15] edge of one of the panels, and said locking groove being open at the rear side of this one panel

The invention is especially well suited for use in joining floor panels, especially thin laminated floors. Thus, the following description of the prior art and of the objects and[20] features of the invention will be focused on this field of use. It should however be emphasised that the invention is useful also for joining ordinary wooden floors as well as other types of building panels, such as wall panels and roof slabs.[25]

BACKGROUND OF THE INVENTION

A joint of the aforementioned type is known e.g. from SE 450,141. The first mechanical connection is achieved by

means of joint edges having tongues and grooves. The locking device for the second mechanical connection comprises [30] two oblique locking grooves, one in the rear side of each panel, and a plurality of spaced-apart spring clips which are distributed along the joint and the legs of which are pressed into the grooves, and which are biased so as to tightly damp the floor panels together. Such a joining [35] technique is especially useful for joining thick floor panels to form surfaces of a considerable expanse.

Thin floor panels of a thickness of about 7-10 mm, especially laminated floors, have in a short time taken a substantial share of the market. All thin floor panels [40] employed are laid as "floating floors" without being attached to the supporting structure. As a rule, the dimension of the floor panels is 200x1200 mm, and their long and short sides are formed with tongues and grooves. Traditionally, the floor [45] is assembled by applying glue in the groove and forcing the floor panels together. The tongue is then glued in the groove of the other panel. As a rule, a laminated floor consists of an upper decorative wear layer of laminate having a thickness of about 1 mm, an intermediate core of particle board or other board, and a base layer to balance the construction [50]. The core has essentially poorer properties than the laminate, e.g. in respect of hardness and water resistance, but it is nonetheless needed primarily for providing a groove and tongue for assemblage. This means that the overall thickness must be at least about 7 mm. These known laminated floors [55] using glued tongue-and-groove joints however suffer from several inconveniences.

First, the requirement of an overall thickness of at least about 7 mm entails an undesirable restraint in connection [60] with the laying of the floor, since it is easier to cope with low thresholds when using thin floor panels, and doors must often be adjusted in height to come clear of the floor laid.

Moreover, manufacturing costs are directly linked with the consumption of material. [65]

Second, the core must be made of moisture-absorbent material to permit using water-based glues when laying the

floor. Therefore, it is not possible to make the floors thinner using so-called compact laminate, because of the absence of suitable gluing methods for such non-moisture-absorbent core materials.

[5] Third, since the laminate layer of the laminated floors is highly wear-resistant, tool wear is a major problem when working the surface in connection with the formation of the tongue.

Fourth, the strength of the joint, based on a glued tongue-[10] and-groove connection, is restricted by the properties of the core and of the glue as well as by the depth and height of the groove. The laying quality is entirely dependent on the gluing. In the event of poor gluing, the joint will open as a result of the tensile stresses which occur e.g. in connection [15] with a change in air humidity.

Fifth, laying a floor with glued tongue-and-groove joints is time-consuming, in that glue must be applied to every panel on both the long and short sides thereof.

Sixth, it is not possible to disassemble a glued floor once [20] laid, without having to break up the joints. Floor panels that have been taken up cannot therefore be used gain. This is a drawback particularly in rental houses where the flat concerned must be put back into the initial state of occupancy. Nor can damaged or worn-out panels be replaced [25] without extensive efforts, which would be particularly desirable on public premises and other areas where parts of the floor are subjected to great wear.

Seventh, known laminated floors are not suited for such use as involves a considerable risk of moisture penetrating [30] down into the moisture-sensitive core.

Eighth, present-day hard, floating floors require, prior to laying the floor panels on hard subfloors, the laying of a separate underlay of floor board, felt, foam or the like, which [35] is to damp impact sounds and to make the floor more pleasant to walk on. The placement of the underlay is a complicated operation, since the underlay must be placed in edge-to-edge fashion. Different under-lays affect the properties of the floor.

[40] There is thus a strongly-felt need to overcome the above-mentioned drawbacks of the prior art. It is however not possible simply to use the known joining technique with glued tongues and grooves for very thin floors, e.g. with floor thicknesses of about 3 mm, since a joint based on a [45] tongue-and-groove connection would not be sufficiently strong and practically impossible to produce for such thin floors. Nor are any other known joining techniques usable for such thin floors. Another reason why the making of thin floors from e.g. compact laminate involves problems is the [50] thickness tolerances of the panels, being about 0.2-0.3 mm for a panel thickness of about 3 mm, A 3-mm compact laminate panel having such a thickness tolerance would have, if ground to uniform thickness on its rear side, an unsymmetrical design, entailing the risk of bulging. [55] Moreover, if the panels have different thicknesses, this also means that the joint will be subjected to excessive load.

Nor is it possible to overcome the above-mentioned problems by using double-adhesive tape or the like on the undersides of the panels, since such a connection catches [60] directly and does not allow for subsequent adjustment of the panels as is The ease with ordinary gluing.

Using U-shaped clips of the type disclosed in the above-mentioned SE 450,141, or similar techniques, to overcome

the drawbacks discussed above is no viable alternative [65] either. Especially, biased clips of this type cannot be used for joining panels of such a small thickness as 3 mm. Normally, it is not possible to disassemble the floor panels without

[3]

having access to their undersides. This known technology relying on clips suffers from the additional drawbacks:

Subsequent adjustment of the panels in their longitudinal direction is a complicated operation in connection with laying, since the clips urge the panels tightly against [5] each other.

Floor laying using clips is time-consuming.

This technique is usable only in those cases where the floor panels are resting on underlying joists with the clips placed therebetween. For thin floors to be laid on [10] a continuous, flat supporting structure, such clips cannot be used.

The floor panels can be joined together only at their long sides. No clip connection is provided on the short sides. [15]

Technical Problems and Objects of the Invention

A main object of the invention therefore is to provide a system for joining together building panels, especially floor panels for hard, floating floors, which allows using floor panels of a smaller overall thickness than present-day floor [20] panels.

A particular object of the invention is to provide a panel-joining system which

makes it possible in a simple, cheap and rational way to provide a joint between floor panels without requiring [25] the use of glue, especially a joint based primarily only on mechanical connections between the panels;

can be used for joining floor panels which have a smaller thickness than present-day laminated floors and which have, because of the use of a different core material superior properties than present-day floors even at a thickness of 3 mm;

makes it possible between thin floor panels to provide a joint that eliminates any unevennesses in the joint because of thickness tolerances of the panels; [35]

allows joining all the edges of the panels;

reduces tool wear when manufacturing floor panels with hard surface layers;

allows repeated disassembly and reassembly of a floor [40] previously laid, without causing damage to the panels, while ensuring high laying quality;

makes it possible to provide moisture-proof floors;

makes it possible to obviate the need of accurate, separate placement of an underlay before laying the floor panels; and

considerably cuts the time for joining the panels.

These and other objects of the invention are achieved by means of a panel-joining system having the features recited [50] in the appended claims.

Thus, the invention provides a system for making a joint along adjacent joint edges of two building panels, especially floor panels, in which joint:

the adjacent joint edges together form a first mechanical [55] connection locking the joint edges to each other in a first direction at fight angles to the principal plane of the panels, and

a locking device arranged on the rear side of the panels forms a second mechanical connection locking the [60] panels to each other in a second direction parallel to the principal plane and at right angles to the joint edges, said locking device comprising a locking groove which extends parallel to and spaced from the

joint edge of one of said panels, termed groove panel, and which is [65] open at the rear side of the groove panel, said system being characterised in

[4]

that the locking device further comprises a strip integrated with the other of said panels, termed strip panel, said strip extending throughout substantially the entire length of the joint edge of the strip panel and being [5] provided with a locking element projecting from the strip, such that when the panels are joined together, the strip projects on the rear side of the groove panel with its locking element received in the locking groove of the groove panel,

[10] that the panels, when joined together, can occupy a relative position in said second direction where a play exists between the locking groove and a locking surface on the locking clement that is facing the joint edges and is operative in said second mechanical connection,

[15] that the first and the second mechanical connection both allow mutual displacement of the panels in the direction of the joint edges, and

that the second mechanical connection is so conceived as to allow the locking element to leave the locking [20] groove ff the groove panel is turned about its joint edge angularly away from the strip.

The term "rear side" as used above should be considered to comprise any side of the panel located behind/underneath the front side of the panel. The opening plane of the locking [25] groove of the groove panel can thus be located at a distance from the rear surface of the panel resting on the supporting structure. Moreover, the strip, which in the invention extends throughout substantially the entire length of

the joint edge of the strip panel should be considered to encompass [30] both the case where the strip is a continuous, uninterrupted element, and the case where the "strip" consists in its longitudinal direction of several parts, together covering the main portion of the joint edge.

It should also be noted (i) that it is the first and the second [35] mechanical connection as such that permit mutual displacement of the panels in the direction of the joint edges, and that (ii) it is the second mechanical connection as such that permits the looking element to leave the locking groove if the groove panel is turned about its joint edge angularly [40] away from the strip. Within the scope of the invention, there may thus exist means, such as glue and mechanical devices, that can counteract or prevent such displacement and/or upward angling.

The system according to the invention makes it possible [45] to provide concealed, precise locking of both the short and long sides of the panels in hard, thin floors. The floor panels can be quickly and conveniently disassembled in the reverse order of laying without any risk of damage to the panels, ensuring at the same time a high laying quality. The panels [50] can be assembled and disassembled much faster than in present-day systems, and any damaged or worn-out panels can be replaced by taking up and re-laying parts of the floor.

According to an especially preferred embodiment of the invention, a system is provided which permits precise joining [55] of thin floor panels having, for example, a thickness of the order of 3 mm and which at the same time provides a tolerance-independent smooth top face at the joint. To this end, the strip is mounted in an equalising groove which is countersunk in the rear side of the strip panel and which [60] exhibits an exact, predetermined distance from its bottom to the front side of the strip panel. The part of the strip projecting behind the groove panel engages a corresponding

equalising groove, which is countersunk in the rear side of the groove panel and which exhibits The same exact, predetermined [65] distance from its bottom to the front side of the groove panel. The thickness of the strip then is at least so great that the rear side of the strip is flush with, and

[5]

preferably projects slightly below the rear side of the panels. In this embodiment, the panels will always rest, in the joint, with their equalising grooves on a strip. This levels out the tolerance and imparts the necessary strength to the joint. The strip transmits horizontal and upwardly-directed forces to [5] the panels and down-wardly-directed forces to the existing subfloor.

Preferably, the strip may consist of a material which is flexible, resilient and strong, and can be sawn. A preferred strip material is sheet aluminium. In an aluminium strip,[10] sufficient strength can be achieved with a strip thickness of the order of 0.5 mm.

In order to permit taking up previously laid, joined floor panels in a simple way, a preferred embodiment of the invention is characterised in that when the groove panel is[15] pressed against the strip panel in the second direction and is mined angularly away from the strip, the maximum distance between the axis of rotation of the groove panel and the locking surface of the locking groove closest to the joint edges is such that the locking element can leave the locking groove[20] without contacting the locking surface of the locking groove. Such a disassembly can be achieved even if the aforementioned play between the locking groove and the locking surface is not greater than 0.2 mm.

According to the invention, the locking surface of the[25] locking element is able to provide a sufficient locking function even with very small heights of the locking surface. Efficient

locking of 3-mm floor panels can be achieved with a locking surface that is as low as 2 mm. Even a 0.5-mm-high locking surface may provide sufficient locking. The [30] term "locking surface" as used herein relates to the part of the locking element engaging the locking groove to form the second mechanical connection.

For optimal function of the invention, the strip and the locking element should be formed on the strip panel with [35] high precision. Especially, the locking surface of the locking element should be located at an exact distance from the joint edge of the strip panel.

Furthermore, the extent of the engagement in the floor panels should be minimised, since it reduces the floor [40] strength.

By known manufacturing methods, it is possible to produce a strip with a locking pin, for example by extruding ahuninium or plastics into a suitable section, which is thereafter glued to the floor panel or is inserted in special [40] grooves. These and all other traditional methods do however not ensure optimum function and an optimum level of economy. To produce the joint system according to the invention, the strip is suitably formed from sheet aluminium, and is mechanically fixed to the strip panel. [50]

The laying of the panels can be performed by first placing the strip panel on the subfloor and then moving the groove panel with its long side up to the long side of the strip panel, at an angle between the principal plane of the groove panel and the subfloor. When the joint edges have been brought [55] into engagement with each other to form the first mechanical connection, the groove panel is angled down so as to accommodate the locking element in the locking groove.

Laying can also be performed by first placing both the strip panel and the groove panel flat on the subfloor and then [60] joining the panels parallel to their principal planes while bending the strip downwards until the locking element snaps

up into the locking groove. This laying technique enables in particular mechanical locking of both the short and long sides of the floor panels. For example, the long sides can be [65] joined together by using the first laying technique with downward angling of the groove panel, while the short sides

[6]

are subsequently joined together by displacing the groove panel in its longitudinal direction until its short side is pressed on and locked to the short side of an adjacent panel in the same row.

[5] In connection with their manufacture, the floor panels can be provided with an underlay of e.g. floor board, foam or felt. The underlay should preferably cover the strip such that the joint between the underlays is offset in relation to the joint between the floor panels.

[10] The above and other features and advantages of the invention will appear from The appended claims and the following description of embodiments of the invention.

The invention will now be described in more detail hereinbelow with reference to the accompanying drawing [15] Figures.

DESCRIPTION OF DRAWING FIGURES

FIGS. **1***a* and **1***b* schematically show in two stages how two floor panels of different thickness are joined together in [20] floating fashion according to a first embodiment of the invention.

FIGS. **2***a-c* show in three stages a method for mechanically joining two floor panels according to a second embodiment of the invention.

[25] FIGS. **3***a-c* show in three stages another method for mechanically joining the floor panels of FIGS. **2***a-c*.

FIGS. **4***a* and **4***b* show a floor panel according to FIGS. **2***a-c* as seen from below and from above, respectively.

[30] FIG. **5** illustrates in perspective a method for laying and joining floor panels according to a third embodiment of the invention.

FIG. **6** shows in perspective and from below a first variant for mounting a strip on a floor panel.

[35] FIG. **7** shows in section a second variant for mounting a strip on a floor panel.

DESCRIPTION OF PREFERRED EMBODIMENTS

[40] FIGS. **1***a* and **1***b*, to which reference is now made, illustrate a first floor panel **1**, hereinafter termed strip panel, and a second floor panel **2**, hereinafter termed groove panel. The terms "strip panel" and "groove panel" are merely intended to facilitate the description of the invention, the [45] panels **1**, **2** normally being identical in practice. The panels **1** and **2** may be made from compact laminate and may have a thickness of about 3 mm with a thickness tolerance of about $\pm$0.2 mm. Considering this thickness tolerance, the [50] panels **1**, **2** are illustrated with different Thicknesses (FIG. **1***b*), the strip panel **1** having a maximum thickness (3.2 mm) and the groove panel **2** having a minimum thickness (2.8 mm).

To enable mechanical joining of the panels **1**, **2** at [55] opposing joint edges, generally designated **3** and **4**, respectively, the panels are provided with grooves and strips as described in the following.

Reference is now made primarily to FIGS. **1***a* and **1***b*, and secondly to FIGS. **4***a* and **4***b* showing the basic design of the [60] floor panels from below and from above, respectively.

From the joint edge **3** of the strip panel **1**, i.e. the one long side, projects horizontally a flat strip **6** mounted at the

factory on the underside of the strip panel **1** and extending throughout the entire joint edge **3**. The strip **6**, which is made [65] of flexible, resilient sheet aluminium, can be fixed mechanically, by means of glue or in any other suitable way. In FIGS. **1***a* and **1***b*. the strip **6** is glued, while in FIGS. **4***a*

[7]

and **4***b* it is mounted by means of a mechanical connection, which will be described in more detail hereinbelow.

Other strip materials can be used, such as sheets of other metals, as well as aluminium or plastics sections. Alternatively, the strip **6** may be integrally formed with the [5] strip panel **1**. At any rate, the strip **6** should be integrated with the strip panel **1**, i.e. it should not be mounted on the strip panel **1** in connection with laying. As a non-restrictive example, the strip **6** may have a width of about 30 mm and a thickness of about 0.5 mm. [10]

As appears from FIGS. **4***a* and **4***b*, a similar, although shorter strip **6'** is provided also at one short side **3'** of the strip panel **1**. The shorter strip **6'** does however not extend throughout the entire short side **3'** but is otherwise identical with the strip **6** and, therefore, is not described in more detail [15] here.

The edge of the strip **6** facing away from the joint edge **3** is formed with a locking element **8** extended throughout The entire strip **6**. The locking element **8** has a locking surface **10** facing the joint edge **3** and having a height of e.g. 0.5 mm. [20] The locking element **8** is so designed that when the floor is being laid and the strip panel **2** of FIG. **1***a* is pressed with its joint edge **4** against the joint edge **3** of the strip panel **1** and is angled down against the subfloor **12** according to FIG. **1***b*, [25] it enters a locking groove **14** formed in the underside of the groove panel **2** and extending parallel to and spaced from the joint edge **4**. In FIG. **1***b*, the locking element **8** and the

locking groove **14** together form a mechanical connection locking the panels **1**, **2** to each other in the direction designated D2. More specifically, the locking surface **10** of the locking element **8** serves as a stop with respect to the surface of the locking groove **14** closest to the joint edge **4**.

When the panels **1** and **2** are joined together, they can however occupy such a relative position in the direction D2 that there is a small play Δ between the locking surface **10** and the locking groove **14**. This mechanical connection in the direction D2 allows mutual displacement of the panels **1**, **2** in the direction of the joint, which considerably facilitates the laying and enables joining together the short sides by snap action. [40]

As appears from FIGS. **4***a* and **4***b*, each panel in the system has a strip **6** at one long side **3** and a locking groove **14** at the other long side **4**, as well as a strip at one short side **3'** and a locking groove **14'** at the other short side **4'**. [45]

Furthermore, the joint edge **3** of the strip panel **1** has in its underside **18** a recess **20** extending throughout the entire joint edge **3** and forming together with the upper face **22** of the strip **6** a laterally open recess **24**. The joint edge **4** of the groove panel **2** has in its top side **26** a corresponding recess [50] **28** forming a locking tongue **30** to be accommodated in the recess **24** so as to form a mechanical connection locking the joint edges **3**, **4** to each other in the direction designated D1. This connection can be achieved with other designs of the joint edges **3**, **4**, for example by a bevel the thereof such that [55] the joint edge **4** of the groove panel **2** passes obliquely in underneath the joint edge **3** of the strip panel **1** to be locked between that edge and the snip **6**.

The panels **1**, **2** can be taken up in the reverse order of laying without causing any damage to the joint, and be laid again.

The strip **6** is mounted in a tolerance-equalizing groove **40** in the underside **18** of the strip panel **1** adjacent the joint edge

3. In this embodiment, the width of the equalizing groove **40** is approximately equal to half the width of the strip **6**, i.e. about 15 mm. By means of the equalizing groove **40**, it is ensured that there will always exist between the top

[8]

side **21** of the panel **1** and the bottom of the groove **40** an exact, predetermined distance E which is slightly smaller than the minimum thickness (2.8 mm) of the floor panels **1, 2.** The groove panel **2** has a corresponding tolerance-[5] equalising surface or groove **42** in the underside **16** of the joint edge **4**. The distance between the equalizing surface **42** and the top side **26** of the groove panel **2** is equal to the aforementioned exact distance E. Further, the thickness of the strip **6** is so chosen that the underside **44** of the strip is [10] situated slightly below the undersides **18** and **16** of the floor panels **1** and **2**, respectively. In this manner, the entire joint will rest on the strip **6**, and all vertical downwardly-directed forces will be efficiently transmitted to the subfloor **12** without any stresses being exerted on the joint edges **3**, **4**. Thanks to the provision of the equalizing grooves **40**, **42**, an [15] entirely even joint will be achieved on the top side, despite the thickness tolerances of the panels **1**, **2**, without having to perform any grinding or the like across the whole panels. Especially, this obviates the risk of damage to the bottom layer of the compact laminate, which might give rise to [20] bulging of the panels.

Reference is now made to the embodiment of FIGS. **2***a-c* showing in a succession substantially the same laying method as in FIGS. **1***a* and **1***b*. The embodiment of FIGS. **2***a-c* primarily differs from the embodiment of FIGS. **1***a* and [25] **1***b* in that the strip **6** is mounted on the strip panel **1** by means of a mechanical connection instead of glue. To provide this mechanical connection, illustrated in more detail in FIG. **6**, a

groove **50** is provided in the underside **18** of the strip panel **1** at a distance from the recess **24**. The groove **50** may be formed either as a continuous groove extending throughout [30] the entire length of the panel **1**, or as a number of separate grooves. The groove **50** defines, together with the recess **24**, a dovetail gripping edge **52**, the underside of which exhibits an exact equalizing distance E to the top side **21** of the strip [35] panel **1**. The aluminium strip **6** has a number of punched and bent tongues **54**, as well as one or more lips **56** which are bent round opposite sides of the gripping edge **52** in clamping engagement therewith. This connection is shown in detail from below in the perspective view of FIG. **6**.

[40] Alternatively, a mechanical connection between the strip **6** and the strip panel **1** can be provided as illustrated in FIG. **7** showing in section a cut-away part of the strip panel **1** turned upside down. In FIG. **7**, the mechanical connection comprises a dovetail recess **58** in the underside **18** of the [45] strip panel **1**, as well as tongues/lips **60** punched and bent from the strip **5** and clamping against opposing inner sides of the recess **58**.

The embodiment of FIGS. **2***a-c* is further characterized in that the locking element **8** of the strip **6** is designed as a [50] component bent from the aluminium sheet and having an operative locking surface **10** extending at right angles up from the front side **22** of the strip **6** through a height of e.g. 0.5 mm, and a rounded guide surface **34** facilitating the insertion of the locking element **8** into the locking groove **14** [55] when angling down the groove panel **2** towards The subfloor **12** (FIG. **2***b*), as well as a portion **36** which is inclined towards the subfloor **12** and which is not operative in the laying method illustrated in FIGS. **2***a-c*.

Further, it can be seen from FIGS. **2***a-c* that the joint edge [60] **3** of the strip panel **1** has a lower bevel **70** which cooperates during laying with a corresponding upper bevel **72** of the joint edge **4** of the groove panel **2**, such that the panels

1 and **2** are forced to move vertically towards each other when their joint edges **3**, **4** are moved up to each other and the [65] panels are pressed together horizontally.

Preferably, the locking surface **10** is so located relative to the joint edge **3** that when the groove panel **2**, starting from

[9]

the joined position in FIG. **2***c*, is pressed horizontally in the direction D2 against the strip panel **1** and is turned angularly up from the strip **6**, the maximum distance between the axis of rotation A of the groove panel **2** and the locking surface **10** of the locking groove is such that the locking element **8** [5] can leave The locking groove **14** without coming into contact with it.

FIGS. **3***a*-**3***b* show another joining method for mechanically joining together the floor panels of FIGS. **2***a*-*c*. The method illustrated in FIGS. **3***a*-*c* relies on the fact that the [10] strip **6** is resilient and is especially useful for joining together the short sides of floor panels which have already been joined along one long side as illustrated in FIGS. **2***a*-*c*. The method of FIGS. **3***a*-*c* is performed by first placing the two panels **1** and **2** flat on the subfloor **12** and then moving them horizontally towards each other according to FIG. **3***b*. The [15] inclined portion **36** of the locking element **8** then serves as a guide surface which guides the joint edge **4** of the groove panel **2** up on to the upper side **22** of the strip **6**. The strip **6** will then be urged downwards while the locking element [20] **8** is sliding on the equalizing surface **42**. When the joint edges **3**, **4** have been brought into complete engagement with each other horizontally, the locking element **8** will snap into the locking groove **14** (FIG. **3***c*), thereby providing the same locking as in FIG. **2***c*. The same locking method can [25] also be used by placing, in the initial position, the joint edge 4 of the groove panel with the

equalizing groove **42** on the locking element **10** (FIG. 3*a*). The inclined portion **36** of the locking element **10** then is not operative. This technique thus makes it possible to lock the floor panels mechanically in all [30] directions, and by repeating the laying operations the whole floor can be laid without using any glue.

The invention is not restricted to the preferred embodiments described above and illustrated in the drawings, but several variants and modifications thereof are conceivable [35] within the scope of the appended claims. The strip **6** can be divided into small sections coveting the major part of the joint length. Further, the thickness of the strip **6** may vary throughout its width. All strips, locking grooves, locking elements and recesses are so dimensioned as to enable [40] laying the floor panels with flat top sides in a manner to rest on the strip **6** in the joint. If the floor panels consist of compact laminate and if silicone or any other sealing compound, a rubber strip or any other scaling device is applied prior to laying between the flat projecting part of the [45] strip **6** and the groove panel **2** and/or in the recess **26**, a moisture-proof floor is obtained.

As appears from FIG. **6**, an underlay **46**, e.g of floor board, foam or felt, can be mounted on the underside of the panels during the manufacture thereof. In one embodiment, [50] the underlay **45** covers the strip **6** up to the locking element **8**, such that the joint between the underlays **46** becomes offset in relation to the joint between the joint edges **3** and **4**.

In the embodiment of FIG. **5**, the strip **6** and its locking [55] element **8** are integrally formed with the strip panel **1**, the projecting part of the strip **6** thus forming an extension of the lower part of the joint edge **3**. The locking function is the same as in the embodiments described above. On the underside **18** of the strip panel **1**, there is provided a separate strip [60], band or the like **74** extending throughout the entire

length of the joint and having, in this embodiment, a width covering approximately the same surface as the separate strip **6** of the previous embodiments. The strip **74** can be provided in directly on the rear side **18** or in a recess formed therein (not [65] shown), so that the distance from the front side **21**, **26** of the floor to the rear side **76**, including the thickness of the strip

[10]

74, always is at least equal to the corresponding distance in the panel having the greatest thickness tolerance. The panels **1**, **2** will then rest, in the joint, on the strip **74** or only on the undersides **18**, **16** of the panels, if these sides are made [5] plane.

When using a material which does not permit downward bending of the strip **6** or the locking element **8**, laying can be performed in the way shown in FIG. **5**. A floor panel **2***a* is moved angled upwardly with its long side **4**a into engage-[10] ment with the long side **3** of a previously laid floor panel **1** while at the same time a third floor panel **2***b* is moved with its short side **4***b*' into engagement with the short side **3***a*' of the upwardly-angled floor panel **2***a* and is fastened by angling the panel **2***b* downwards. The panel **2***b* is then pushed along the short side **3***a*' of the upwardly-angled floor [15] panel **2***a* until its long side **4***b* encounters the long side **3** of The initially-laid panel **1**. The two upwardly-angled panels **2***a* and **2***b* are therefore angled down on to the subfloor **12** so as to bring about locking.

By a reverse procedure the panels can be taken up in The [20] reverse order of laying without causing any damage to the joint, and be laid again.

Several variants of preferred laying methods are conceivable. For example, the strip panel can be inserted

under the groove panel, thus enabling the laying of panels in all four [25] directions with respect to the initial position.

What is claimed:

1. A system for providing a joint between adjacent building panels, comprising:

each of said building panels including a first edge and a [30] second edge such that the first edge of each of said building panels forms a first mechanical connection with the second edge of an adjacent one of the building panels locking the first and second edges of the building panels to each other in a first direction at right [35] angles to a principal plane of the panels, and

a locking device arranged on a rear side of the building panels forming a second mechanical connection locking the building panels to each other in a second direction parallel to the principal plane and at right [40] angles to the first and second edges, said locking device fitting within a locking groove extending parallel to and spaced apart from the first edge of said building panels, and which locking groove is open at the rear side of the [45] building panels,

the locking device comprising a strip integrated with the second edge of each of said budding panels, said strip extending throughout substantially an entire length of the second edge and being provided with a locking [50] element projecting from the strip, such that when two adjacent building panels are joined together, the strip projects from the rear side of the second edge of the panels with its locking element received in the locking groove of an adjacent building panel,

[55] the building panels, when joined together, can occupy a relative position in said second direction where a play exists between the locking groove and a locking surface on the locking element that is facing

the first and second edges and is operative in said second mechanical connection, [60]

the first and the second mechanical connections both allow mutual displacement of the building panels in a direction of the first and second edges, and

the second mechanical connection enables the locking [65]element to leave the locking groove if the respective building panel is turned about its first edge angularly away from the strip.

[11]

2. A system as claimed in claim **1**, wherein when the first edge is pressed against the second edge of the adjacent panel in said second direction and is turned angularly away from the strip, the maximum distance between the axis of rotation of the first edge and the locking surface of the locking groove[5] closest to the first and second edges is such that the locking element can leave the locking groove without contacting the locking surface of the locking groove.

3. A system as claimed in claim **1** wherein, the locking surface of the locking element (**22**) is extended from a front[10] side (**22**) of the strip through a height in said first direction that is less than or equal to 2 mm.

4. A system as claimed in claim **1**, wherein the first mechanical connection is provided by the first edge engaging, in said first direction, between the second edge of [15] the adjacent panel and a front side of the strip.

5. A system as claimed in claim **1**, wherein the strip is made of a material different from that of the panel and fixedly mounted on the panel at the factory.

6. A system as claimed in claim **5**, wherein the strip (**6**), [20] at least for one of the two panels, is received in a counter-sunk groove in the rear side of this one panel.

7. A system as claimed in claim 5, wherein the strip is mounted in an equalising groove which is countersunk in the rear side of the panel and exhibits an [25] exact, predetermined distance from its bottom to the front side of the panel,

the part of the strip projecting behind the adjacent panel engages a corresponding equalising groove which is countersunk in the rear side of the adjacent panel and [30] which exhibits the same exact, predetermined distance from its bottom to the front side of the adjacent panel, and

the strip has at least such a thickness that the rear side of the strip is flush with the rear sides of the panels. [35]

8. A system as claimed in claim 7, wherein the strip has such a thickness that it is only partly received in the equalising grooves.

9. A system as claimed in claim 5, wherein the strip is fixed to the strip panel by means of a mechanical connection.[40]

10. A system as claimed in claim 9, wherein the mechanical connection between the strip and the panel comprises a gripping edge defined by two recesses in the rear side of the panel, and tongues, lips or the like which are bent or punched from the strip and which press against opposite[45] outer sides of the gripping edge.

11. A system as claimed in claim 9, wherein the mechanical connection between the strip and the panel comprises a recess in the rear side of the panel, and tongues, lips or the like which are bent or punched from the strip and which [50] press against opposing inner sides of the recess.

12. A system as claimed in claim 5, wherein the strip is fixed to the panel by means of a binder.

13. A system as claimed in claim 5, wherein the strip is made of a flexible, preferably resilient material, such as [55] sheet aluminum.

14. A system as claimed in claim **1**, wherein the locking element consists of a locking edge extended continuously along the strip.

15. A system as claimed in claim **1**, wherein the locking[60] element consists of a plurality of spaced-apart locking elements distributed throughout the length of the strip.

16. A system as claimed in claim **1**, wherein the panels are rectangular and intended, at each of their four edges, to be joined to a similar panel by a first mechanical connection of the aforementioned type and a second mechanical connection of the aforementioned type, each panel having a first

[12]

pair of first and second edges, one of which is provided with a strip of the aforementioned type and the other of which is provided with a locking groove of the aforementioned type, and a second pair of opposite first and second edges, one of [5] which is provided with a strip of the aforementioned type and the other of which is provided with a locking groove of the aforementioned type.

17. A system as claimed in claim **1**, wherein an underlay of floor boards, foam, felt or the like is fixed to the rear sides [10] of the panels.

18. A system as claimed in claim **17**, wherein the underlay is fixed so as to cover the strip in said second direction at least up to the locking element, such that a joint between the underlays of the two adjacent panels is offset in said second direction relative to the first and second edges.

[15] **19**. A system as claimed in any one of the preceding claims, wherein a sealing means, such as a sealing compound, a rubber strip or the like, is provided on the front side of the strip between the locking element and the first edge of the strip panel to seal against the adjacent panel.

[20] **20**. A system as claimed in claim **2**, wherein the locking surface of the locking element is extended from the front side of the strip through a height in said first direction that is less than or equal to 2 mm.

21. A system for providing a joint between adjacent [25] building panels, comprising:

each of said building panels including a first edge and a second edge such that the first edge of each of said building panels forms a first mechanical connection [30] with the second edge of an adjacent one of the building panels locking the first and second edges of the building panels to each other in a first direction at fight angles to a principal plane of the panels, and

a locking device arranged on a rear side of the building panels forming a second mechanical connection locking the building panels to each other in a second direction parallel to the principal plane and at right angles to the first and second edges, said locking device fitting within a locking groove extending parallel to and [40] spaced apart from the first edge of said building panels, and which locking groove is open at the rear side of the building panels,

the locking device comprising a strip integrally formed with the second edge of each of said building panels, [45] said strip extending throughout substantially an entire length of the second edge and being provided with a locking element projecting from the strip, such that when two adjacent building panels are joined together, the strip projects from the rear side of the second edge [50] of the panels with its locking element received in the locking groove of an adjacent building panel,

the first and the second mechanical connections both allow mutual displacement of the building panels in a direction of the first and second edges, and

[55] the second mechanical connection enables the locking element to leave the locking groove if the respective building panel is turned about its first edge angularly away from the strip.

22. A system for providing a joint between adjacent [60] building panels, comprising:

each of said building panels including a first edge and a second edge such that the first edge of each of said building panels forms a first mechanical connection with the second edge of an adjacent one of the building [65] panels locking the first and second edges of the building panels to each other in a first direction at right angles to a principal plane of the panels, and

[13]

a locking device arranged on a rear side of the building panels forming a second mechanical connection locking the building panels to each other in a second direction parallel to the principal plane and at right angles to the first and second edges, said locking device [5] fitting within a locking groove extending parallel to and spaced apart from the first edge of said building panels, and which locking groove is open at the rear side of the building panels,

the locking device comprising a strip integrated with the[10] second edge of each of said building panels, said strip extending throughout substantially an entire length of the second edge and being provided with a locking element projecting from the strip, such that when two adjacent building panels are joined together, the strip [15] projects from the rear side of the second edge of the panels with its locking element received in the locking groove of an adjacent building panel,

the first and the second mechanical connections both allow mutual displacement of the building panels in a [20] direction of the first and second edges, and

the second mechanical connection enables the locking element to leave the locking groove if the respective building panel is turned about its first edge angularly [25] away from the strip.

23. A system for providing a joint between adjacent building panels, comprising:

each of said building panels including a first edge and a second edge such that the first edge of each of said [30] building panels forms a first mechanical connection with the second edge of an adjacent one of the building panels locking the first and second edges of the building panels to each other in a first direction at right angles to a principal plane of the panels, and [35]

a locking device arranged on a rear side of the building panels forming a second mechanical connection lock-

[14]

ing the building panels to each other in a second direction parallel to the principal plane and at right angles to the first and second edges, said locking device fitting within a locking groove extending parallel to and [5] spaced apart from the first edge of said building panels, and which locking groove is open at the rear side of the building panels,

the locking device comprising a strip integrated with the second edge of each of said building panels, said strip [10] being provided with a locking element projecting from the strip, such that when two adjacent building panels are joined together, the strip projects from the rear side of the second edge of the panels with its

locking element received in the locking groove of an adjacent [15]building panel,

the first and the second mechanical connections both allow mutual displacement of the building panels in a direction of the first and second edges, and

the second mechanical connection enables the locking [20] element to leave the locking groove if the respective building panel is turned about its first edge angularly away from the strip;

wherein the strip is mounted in an equalizing groove [25] which is countersunk in the rear side of each of the building panels and exhibits an exact, predetermined distance from its bottom to the front side of the panel,

the part of the strip projecting behind the adjacent panel engages a corresponding equalising groove which is countersunk in the rear side of the adjacent panel and which exhibits the same exact, predetermined distance from its bottom to the front side of the adjacent panel, and

the strip has at least such a thickness that the rear side of the strip is flush with the rear sides of the panels.

* * * * *

APPENDIX I

Patent Application Serial No. 08/436224

U.S. Department of Commerce
Patent and Trademark Office
Fee Record Sheet

See
Fold Out Exhibit

PCT Application
Claims
and
Examiner's Action

EDITOR'S NOTE

THE FOLLOWING PAGES WERE POOR HARD COPY AT THE TIME OF FILMING. IF AND WHEN A BETTER COPY CAN BE OBTAINED, A NEW FICHE WILL BE ISSUED.

What is claimed:

1. A system for providing a joint along adjacent joint edges (3, 4) of two building panels (1, 2), especially floor panels, in which joint:

the adjacent joint edges (3, 4) together form a first mechanical connection locking the joint edges (3, 4) to each other in a first direction (D1) at right angles to the principal plane of the panels (1, 2), and

a locking device (6, 8, 14) arranged on the rear side (18, 16) of the panels (1, 2) forms a second mechanical connection locking the panels (1, 2) to each other in a second direction (D2) parallel to the principal plane and at right angles to the joint edges (3, 4), said locking device (6, 8, 14) comprising a locking groove (14) which extends parallel to and spaced from the joint edge (4) of one (2) of said panels, termed groove panel, and which is open at the rear side (16) of the groove panel (2), characterised in

that the locking device (6, 8, 14) further comprises a strip (6) integrated with the other (1) of said panels, termed strip panel, said strip (6) extending throughout substantially the entire length of the joint edge (3) of the strip panel (1) and being provided with a locking element (8) projecting from the strip, such that when the panels are joined together, the strip (6) projects on the rear side of the groove panel (2) with its locking element (8) received in the locking groove (14) of the groove panel (2),

that the panels, when joined together, can occupy a relative position in said second direction (D2) where a play (A) exists between the locking groove (14) and a locking surface (10) on the locking element (8) that is facing the joint edges and is operative in said second ~~mechanical connection~~

11

that the first and the second mechanical connection both allow mutual displacement of the panels (1, 2) in the direction of the joint edges (3, 4), and

that the second mechanical connection is so conceived as to allow the locking element (8) to leave the locking groove (14) if the groove panel (2) is turned about its joint edge (3) angularly away from the strip (6).

2. A system as claimed in claim 1, wherein ~~characterized in that~~ when the groove panel (2) is pressed against the strip panel (1) in said second direction (D2) and is turned angularly away from the strip (6), the maximum distance between the axis of rotation of the groove panel (2) and the locking surface of the locking groove (14) closest to the joint edges is such that the locking element (8) can leave the locking groove (14) without contacting the locking surface of the locking groove (14).

3. A system as claimed in claim 1 or 2, wherein ~~characterized in that~~ the locking surface (16) of the locking element (8) is extended from a front side (22) of the strip (6) through a height in said first direction that is less than or equal to 2 mm.

4. A system as claimed in any one of the preceding claim 1, wherein ~~claims, characterized in that~~ the first mechanical connection is provided by the joint edge (4) of the groove panel (2) engaging, in said first direction (D1), between the joint edge (3) of the strip panel (1) and the front side of the strip (6).

5. A system as claimed in any one of the preceding claim 1, wherein ~~claims, characterized in that~~ the strip (6) integrated with the strip panel (1) is made of a material different from that of the strip panel (1) and fixedly mounted on the strip panel (1) at the factory.

6. A system as claimed in claim 5, wherein ~~characterized in that~~ the strip (6) at least for one of the two panels (1, 2) is received in a countersunk

groove ~~(40; 42)~~ in the rear side ~~(16; 16')~~ of this one panel ~~(11; 27)~~.

7. A system as claimed in claim 5 ~~or 6~~, wherein ~~characterized in~~ that the strip ~~(6)~~ is mounted in an equalising groove ~~(40)~~ which is countersunk in the rear side ~~(10')~~ of the strip panel ~~(11)~~ and exhibits an exact, predetermined distance ~~(E)~~ from its bottom to the front side ~~(21')~~ of the strip panel ~~(11)~~.

~~that~~ the part of the strip ~~(6)~~ projecting behind the groove panel ~~(27)~~ engages a corresponding equalising groove ~~(42)~~ which is countersunk in the rear side ~~(16)~~ of the groove panel ~~(27)~~ and which exhibits the same exact, predetermined distance ~~(E)~~ from its bottom to the front side ~~(20')~~ of the groove panel ~~(27)~~, and

~~that~~ the strip ~~(6)~~ has at least such a thickness that the rear side ~~(44)~~ of the strip is flush with the rear sides ~~(10, 16')~~ of the panels.

8. A system as claimed in claim 7, wherein ~~characterized in that~~ the strip ~~(6)~~ has such a thickness that it is only partly received in the equalising grooves ~~(40, 42)~~.

9. A system as claimed in ~~any one of claims 5-8~~, claims 5 wherein ~~characterized in that~~ the ~~strip~~ ~~(6)~~ is fixed to the strip panel ~~(11)~~ by means of a mechanical connection.

10. A system as claimed in claim ~~6~~ 9, wherein ~~characterized in that~~ the mechanical connection between the strip ~~(6)~~ and the ~~strip~~ panel ~~(11)~~ comprises a gripping edge ~~(33)~~ defined by two recesses ~~(24, 50)~~ in the rear side ~~(10')~~ of the ~~strip~~ panel, and tongues, lips or the like ~~(34, 35)~~ which are bent or punched from the strip ~~(6)~~ and which press against opposite outer sides of the gripping edge ~~33~~.

11. A system as claimed in claim ~~6~~ 9, wherein ~~characterized in that~~ the mechanical connection between the strip ~~(6)~~ and the ~~strip~~ panel ~~(11)~~ comprises a recess

~~(58)~~ in the rear side ~~(12)~~ of the ~~strip~~ panel, and tongues, lips or the like ~~(60)~~ which are bent or punched from the strip ~~(6)~~ and which press against opposing inner sides of the recess ~~(58)~~.

12. A system as claimed in ~~any one of claims 5-11~~ claim 5, ~~characterised in that~~ wherein the strip ~~(6)~~ is fixed to the ~~core~~ panel ~~(2)~~ by means of a binder.

13. A system as claimed in ~~any one of claims 5-12~~ claim 5, ~~characterised in that~~ wherein the strip ~~(6)~~ is made of a flexible, preferably resilient material, such as sheet aluminium.

14. A system as claimed in ~~any one of the preceding claims~~ claim 1, ~~characterised in that~~ wherein the locking element ~~(6)~~ consists of a locking edge extended continuously along the strip ~~(6)~~.

15. A system as claimed in ~~any one of claims 1-13~~ claim 1, ~~characterised in that~~ wherein the locking element ~~(6)~~ consists of a plurality of spaced-apart locking elements distributed throughout the length of the strip ~~(6)~~.

16. A system as claimed in ~~any one of the preceding claims~~ claim 1, ~~characterised in that~~ wherein the panels ~~(2)~~ ~~3~~ are rectangular and intended, at each of their four edges ~~(3, 4, 5, 6)~~, to be joined to a similar panel by a first mechanical connection of the aforementioned type and a second mechanical connection of the aforementioned type, each panel having a first pair of opposite joint edges ~~(3, 4)~~, one of which is provided with a strip ~~(6)~~ of the aforementioned type and the other of which is provided with a locking groove ~~(7)~~ of the aforementioned type, and a second pair of opposite joint edges ~~(5, 6)~~, one of which is provided with a strip ~~(6)~~ of the aforementioned type and the other of which is provided with a locking groove ~~(7)~~ of the aforementioned type.

17. A system as claimed in ~~any one of the preceding claims~~ claim 1, ~~characterised in that~~ wherein an underlay ~~(8)~~ of floor boards, foam, felt or the like is fixed to the rear sides ~~(9, 10)~~ of the panels.

18. A system as claimed in claim 17, ~~characterized in that~~ wherein the underlay ~~(46)~~ is fixed so as to cover the strip ~~(6)~~ in said second direction at least up to the locking element ~~(8)~~, such that a joint between the underlays ~~(46)~~ of the two adjacent panels is offset in said second direction relative to the ~~joint~~ first and second edges ~~(3, 4)~~.

19. A system as claimed in any one of the preceding claims, ~~characterized in that~~ wherein a sealing means, such as a sealing compound, a rubber strip or the like, is provided on the front side ~~(22)~~ of the strip between the locking element ~~(8)~~ and the ~~joint~~ first edge ~~(3)~~ of the strip panel to seal against the ~~groove~~ adjacent panel ~~(21)~~.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.

EXAMINER	
ART UNIT	PAPER NUMBER
	7

[illegible] - DUFFETT JR
[illegible] DIANE SWECKER [illegible]
[illegible] 1404
[illegible] VA 22313-[illegible]

DATE MAILED: [illegible]

This is a communication from the examiner in charge of your application
COMMISSIONER OF PATENTS AND TRADEMARKS

☒ This application has been examined ☐ Responsive to communication filed on _____ ☐ This action is made final

A shortened statutory period for response to this action is set to expire 3 month(s), 0 days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☒ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☒ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474
6. ☐ _____

Part II SUMMARY OF ACTION

1. ☒ Claims 1-20 are pending in the application.
   Of the above, claims 12 is are withdrawn from consideration.
2. ☐ Claims _____ have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☒ Claims 1-11 & 13-20 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☒ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____, has (have) been ☐ approved by the examiner ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____
13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

EXAMINER'S ACTION

PTOL-326 (Rev. 2/93)

Claim Rejections - 35 USC §102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States.

8. Claims 1,4,6, and 14-18 are rejected under 35 U.S.C. §102(b) as being anticipated by TROTTER, Jr. TROTTER, Jr. teaches the use of a resilient floor system consisting of floor panels (21,23,25) joined by tongue (47) and groove (49) connection and interconnected by spring clip (33). The clip (33) of TROTTER, Jr. engages grooves (37,43) located on the underside of floor panels (21,23,25). Clip (33) of TROTTER, Jr. further comprises cleats (39) spaced longitudinally along the locking leg (35). TROTTER, Jr. further teaches the use of an underlay (11) on which the resilient flooring system is to be placed.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

1,988,201

5,029,425

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yvonne Horton-Richardson whose telephone number is (703) 308-2168.

YHP YHP
June 10, 1996

Carl

Carl D. Friedman
Supervisory Patent Examiner
Group 3500

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

[October 15, 1996]

In re Patent: Application of)	Box: Non-Fee Amendment
Tony PERVAN)	Group Art Unit: 3504
Application No.: 0S/436,224)	Examiner: Horton-Richardson
Filed: May 17, 1995)	
For: SYSTEM FOR JOINING BUILDING BOARDS)	

AMENDMENT

Application Serial No. 08/436.224
Attorney's Docket No. 003300-339

REMARKS

[p.9]

Prior Art Rejection:

Claims 1, 4, 6, and 14-18 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,819,932, issued to Trotter, Jr. (hereinafter "Trotter").

There are several important distinctions between the floor system disclosed by Trotter and the system of the present invention. In particular, Trotter is intended to provide a springlike floor surface. In addition, it is not an intention that Trotter be removable. In contrast to Trotter, it is not an intention of the present invention to provide a springlike floor surface. In further contrast to Trotter, it is an important object of the present invention to provide a removable flooring system. With these distinctions in mind, several distinctions between the claims of the present application and Trotter will now be discussed.

First, the system of claim 1 defines a strip that is integrated with one of the panels. Trotter does not teach or suggest such a strip that is integrated with a panel.

Furthermore, claim 1 further defines the strip as "extending throughout substantially an entire length of the joint edge of the strip panel". Not only does Trotter not teach or suggest a strip integrated with another panel, it clearly does not teach or suggest such a strip as extending throughout substantially an entire length of the joint edge.

Trotter also does not teach or suggest a system wherein two panels, when joined together, occupy a relative position where a play exists between a locking groove and a locking surface on locking element that is facing the joint edges.

Specifically, Trotter uses spring clips to hold the boards together so as to prevent play from occurring between the two boards. The claimed "play" of the present invention is important for two reasons. One, it enables the panels to slide movably with respect to each other along the direction of the joint edge, which is specifically claimed in the penultimate paragraph of claim 1. This movability allows the short ends of the panels to be placed adjacent each other when installing the floor. Second, the play further enables disassembly of the floor when required.

In contrast to the claimed "play" of the present invention, Trotter specifically states that an intention of his invention is to use the spring clips to hold the boards close together in order to prevent pinching. Thus, Trotter specifically prevents the claimed play. Furthermore, the spring clips of Trotter also further prevent the claimed mutual displacement of the panels in the direction of the joint edges.

To further distinguish Trotter from the claimed "mutual displacement" feature of the present invention, the Examiner's attention is directed to column 4, lines 10-15, wherein the cleats 39 are described. As set forth in the specification of Trotter, the cleats 39 are intended to lock the spring clips 33 into the groove of the board in which the clip is attached. Thus, the cleats 39 clearly prevent any mutual displacement. Even without the cleats 39, the springlike force of the clips 33 and the edges thereof would clearly prevent any mutual displacement of the panels in a direction of the joint edges.

Trotter also does not teach or suggest the feature of the present invention that is defined in the last claim of claim 1, i.e., that the second mechanical connection enables the locking element to leave the locking groove if the groove panel is turned about its joint edge angularly away from the strip. This claimed function is simply not possible in the floor system disclosed by Trotter. Trotter's system cannot be easily taken up after it is installed. Subsequent to the assembly of the

Trotter floor system, the cleats 39 will effectively engage the sides of the locking grooves, whereby any attempt to turn a floor panel upwards will fail.

Accordingly, it should now be clear that the system of Trotter is completely different from that of the present invention. The Trotter patent does not teach or suggest several of the important features that are defined in claim 1. Accordingly, the Examiner is respectfully urged to reconsider and withdraw the rejection of claim 1 based on Trotter.

In view of the differences in the objects and performance of the claimed floor system and the Trotter floor system, it should also be clear that the claimed invention defined in claim 1 is also not obvious in view of Trotter. Accordingly, the Examiner is respectfully requested to withdraw the rejection of claim 1 based on Trotter.

Claims 2-20 depend from claim 1, and are thus also patentable over Trotter at least for the reasons set forth above with respect to claim 1.

Although several amendments have been made to the claims of the present application, it should be noted that such amendments have been made simply to remove reference numerals and provide antecedent basis where necessary for certain of the claim elements. The amendments to the claims are not intended and do not alter the scope of the claim, and thus may not be used as the basis for making a subsequent rejection final.

In view of the fact that claim 1 is now in condition for allowance, the Examiner is respectfully requested to consider claim 12.

In the event that there are any questions concerning this Amendment, or the application in general, the Examiner is respectfully urged to telephone the undersigned attorney so that prosecution of the application may be expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By:

William C. Rowland
Registration No. 30,888

Post Office Box 1404
Alexandria, Virginia 223!3-1404
(703) 836-6620

Date: October 15, 1996

See
Fold Out Exhibit

PCT Application
Office Action Summary

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO

EXAMINER	
ART UNIT	PAPER NUMBER
	11

DATE MAILED:

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

OFFICE ACTION SUMMARY

Responsive to communication(s) filed on 10/15/96

This action is FINAL.

Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire _____ month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

- [X] Claim(s) 1-20 is/are pending in the application.
  - Of the above, claim(s) 12 is/are withdrawn from consideration.
- [ ] Claim(s) _____ is/are allowed.
- [ ] Claim(s) _____ is/are rejected.
- [X] Claim(s) 1-11 & 13-20 is/are objected to.
- [ ] Claims _____ are subject to restriction or election requirement.

Application Papers

- [ ] See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- The drawing(s) filed on _____ is/are objected to by the Examiner.
- The proposed drawing correction, filed on _____ is [ ] approved [ ] disapproved.
- The specification is objected to by the Examiner.
- The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- [ ] All [ ] Some* [ ] None of the CERTIFIED copies of the priority documents have been
  - [ ] received.
  - [ ] received in Application No. (Series Code/Serial Number) _____.
  - [ ] received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- *Certified copies not received: _____.
- Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- [X] Notice of Reference Cited, PTO-892
- [ ] Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- [ ] Interview Summary, PTO-413
- [ ] Notice of Draftsperson's Patent Drawing Review, PTO-948
- [ ] Notice of Informal Patent Application, PTO-152

-- SEE OFFICE ACTION ON THE FOLLOWING PAGES --

BEST AVAILABLE COPY

Allowable Subject Matter

4. The examiner is withholding the previous indication of allowance until the 35 USC § 112 problems indicated above are cleared.

5. Claims 1-20 would be allowable if rewrinen or amended to overcome the rejection(s) under 35 U.S.C. 112 set forth in this Office action.

6. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach the use of adjacent joint floor paneling wherein the floor panels are interconnected by locking element located within a groove formed on the underside in such a way so as to allow for displacement of the panels in a direction toward the joints and to allow for the locking member to be released from the groove when the panel is rotated about the joint.

7. Any inquiry, concerning this communication or earlier communications from the examiner should be directed to Yvonne Horton-Richardson whose telephone number is (703) 308-2168.

December 24, 1996

Attorney's Docket No. 003300-339

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

[June 6, 1997]

In re Patent Application of	)
	) Group Art Unit: 3504
Tony PERVAN	)
	) Examiner: Horton-
Application No.: 08/436,224	) Richardson
	)
Filed: May 17, 1995	)
	)
For: SYSTEM FOR JOINING BUILDING BOARDS	)

AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Official Action dated January 6, 1997, please amend the above-identified patent application as follows:

IN THE CLAIMS:

[p.7]

22. A system for providing a joint between adjacent building panels, comprising:

each of said building panels including a first edge and a second edge such that the first edge of each of said building panels forms a first mechanical connection wiuh the second edge of an adjacent one of the building panels locking the first and second edges of the building panels to each other in a first direction at right angles to a principal plans of the panels, and

a locking device arranged on a rear side of the building panels forming a second mechanical connection locking the building panels to each other in a second direction parallel to the principal plane and at right angles to the first and second edges, said locking device fitting within a locking groove extending parallel to and spaced apart from the first edge of said building panels, and which locking groove is open at the rear side of the building panels,

the locking device comprising a strip integrated with the second edge of each of said building panels, said strip extending throughout substantially an entire length of the second edge and being provided with a locking element projecting from the strip, such that when two adjacent building panels are joined together, the strip projects from the rear side of the second edge of the panels with its locking element received in the locking groove of an adjacent building panel,

the first and the second mechanical connections both allow mutual displacement of the building panels in a direction of the first and second edges, and

the second mechanical connection enables the locking element to leave the locking groove if the respective building panel is turned its first edge angularly away from the strip.

REMARKS

[p.11]

Reconsideration of the above-identified patent application is respectfully requested. The Examiner is thanked for the telephone interview with applicant's attorney on December 16, 1996, and her helpful suggestions for amending the claims.

However, upon careful review of the application, it was determined that more significant amendments to the claims would be appropriate than those suggested by the Examiner. In particular, the claims have been amended to clarify that each of the building panels have first and second edges, wherein the locking groove is adjacent uo the first edge and the strip extends from the second edge. The foregoing amendments do not preclude the concept that in unusual situations one edge of the building panel may be irregular in order to fit against a wall or other structure.

It is believed that the foregoing amendments to the claims respond in detail to each of the issues raised by the Examiner, and thus should overcome the rejection rendered under 35 U.S.C. §112, second paragraph. In the event that the Examiner feels that additional amendments are necessary, the Examiner is respectfully urged to telephone the undersigned attorney so that such amendments may be discussed and implemented as quickly as possible.

To further define the protection to which applicant is entitled, new claims 21-23 are submitted herewith. New independent claim 21 is substantially similar to claim 1 except that it defines the strip as being integrally formed with the second edge of each of the building panels. Accordingly, claim 21 is also in condition for allowance.

New independent claim 22 is substantially the same as independent claim 1 except that it does not define the play that

exists between the locking groove and the locking surface. As such, displacement of the panels is still facilitated in a direction along the joints which is what is believed to be meant by the Examiner's Statement of Reasons for the indication of allowable subject matter. Accordingly, claim 22 is also patentable over the cited prior art.

New independent claim 23 is similar to dependent claim 7 rewritten in independent form, except that it has omitted a couple of details of the original claim 1. Nevertheless, it is clear that the subject matter of new independent claim 23 is clearly patentable over the cited prior for the same reasons that apply to claim 1. Accordingly, new independent claim 23 is also in condition for allowance.

Accordingly, the present application should now be in condition for allowance.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

William C. Rowland
Registration No. 30,888

Post Office Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620
Date: June 6, 1997

APPENDIX J

UNITED STATES PATENT

Patent No. 4,819,932

See Foldout Exhibits
Diagrams

United States Patent [19]

Trotter, Jr.

[11] **Patent Number: 4,819,932**

[45] **Date of Patent: Apr. 11, 1989**

[54] **AEROBIC EXERCISE FLOOR SYSTEM**

[76] Inventor: **Phil Trotter, Jr.**, 9292 East 131st St., Noblesville, Ind. 46060

[21] Appl. No.: **834,819**

[22] Filed: **Feb. 28, 1986**

[51] **Int. Cl.**[4] **A63J 3/00**

[52] **U.S. Cl.** **272/3**; 52/480; 52/309.8

[58] **Field of Search** 272/3, 109; 52/480, 52/390, 393, 309.8, 384, 385, 386, 387, 388, 389

[56] **References Cited**

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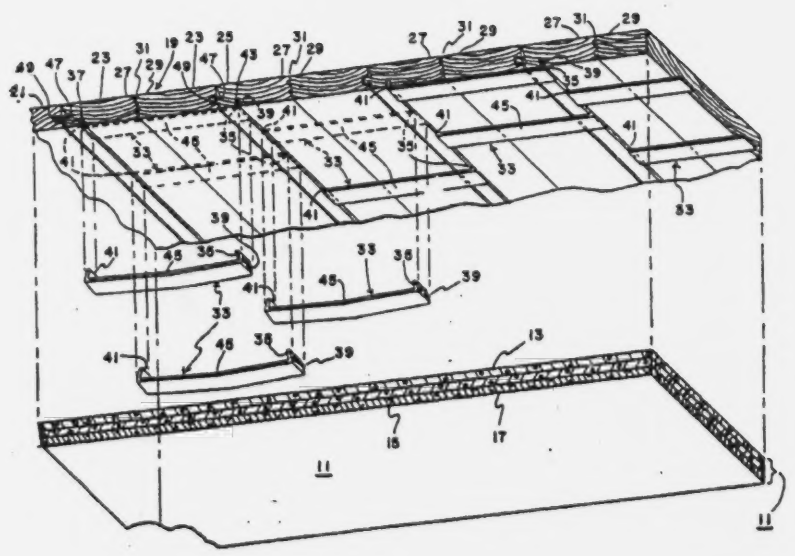
Primary Examiner—Robert A. Hafer
Assistant Examiner—Sam Rimell
Attorney, Agent, or Firm—Richard C. Litman

[57] **ABSTRACT**

A resilient wood floor for aerobic exercise. The boards of the floor are free to pivot in tongue and groove joints. The wood is laid on a foam pad which will always yield during ordinary human exercises. The boards are held together by spring clips which lengthen when a load is applied to the boards, while holding the boards close together in a manner to prevent pinching.

7 Claims, 2 Drawing Sheets



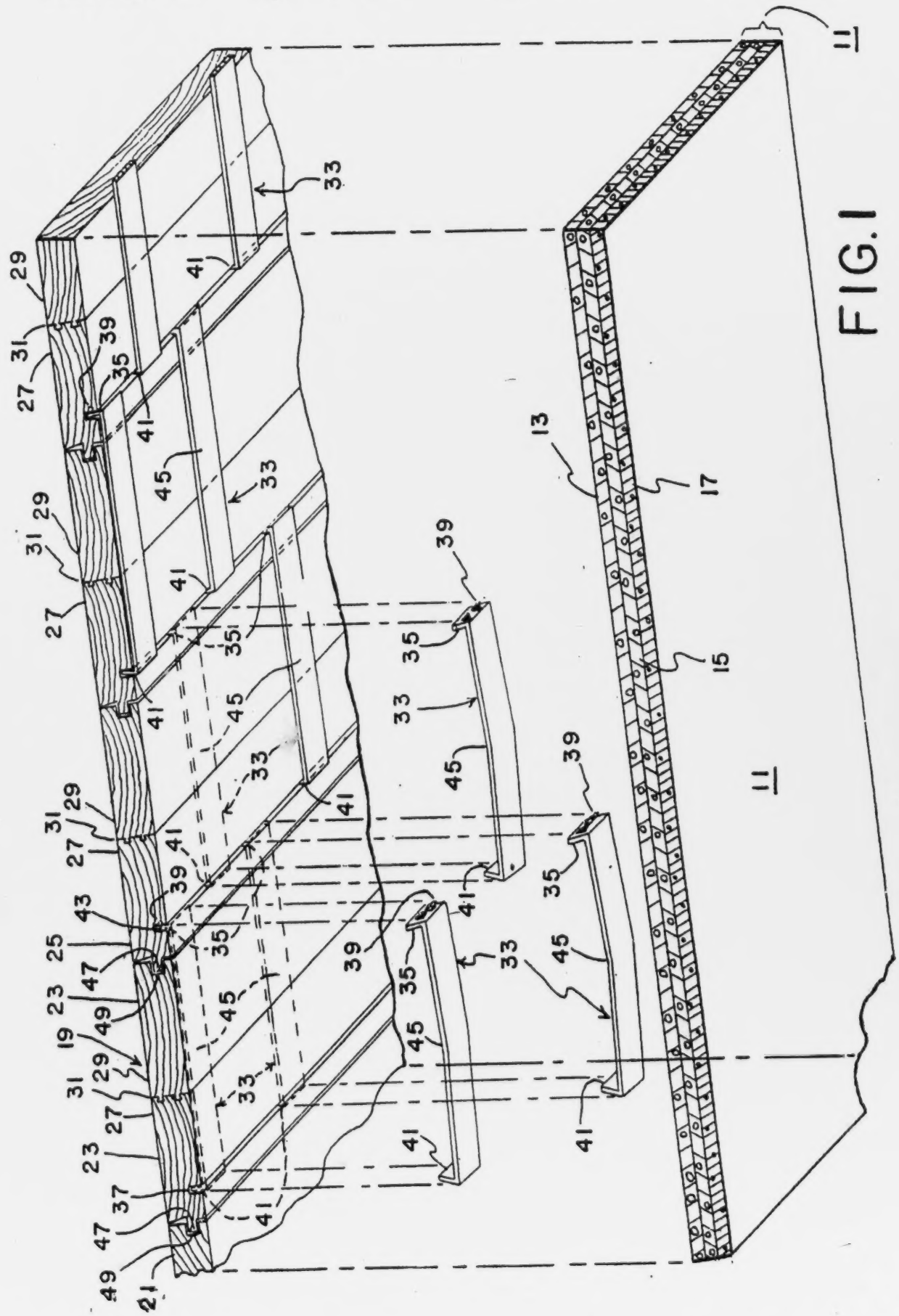


FIG. 1

FIG. 2A

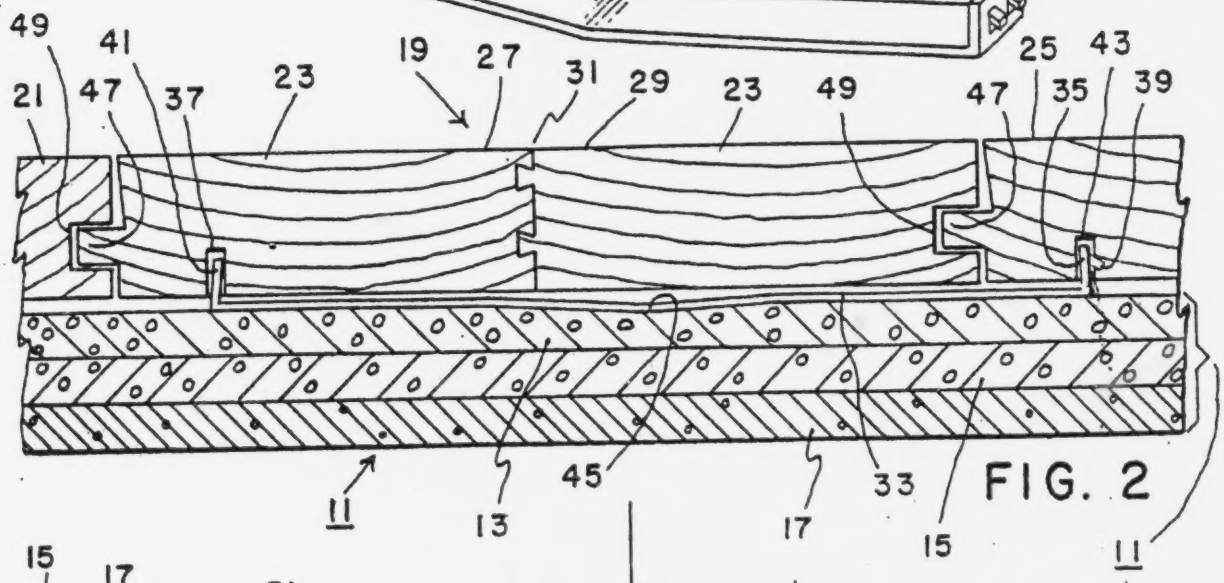


FIG. 2

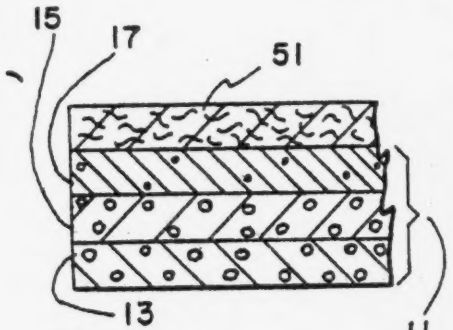


FIG. 4

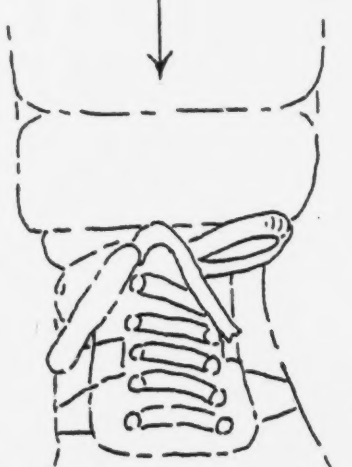
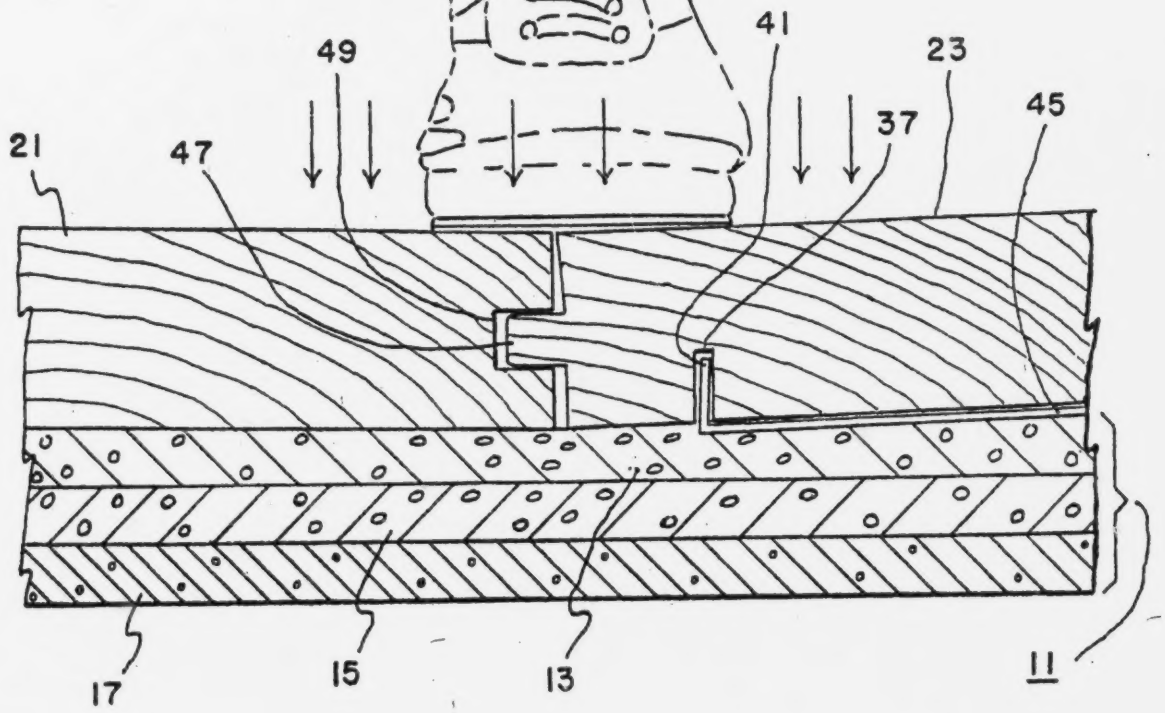


FIG. 3



4,819,932

[1]

AEROBIC EXERCISE FLOOR SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to aerobic exercise floor systems[5] having the type of resiliency satisfying participants, to pads suitable for creating such floor systems, and to spring clips for holding the wear layer in place and in allowing the wear layer to flex.

A major concern of aerobic professionals is the disproportionate [10] number of instructors and participants who become injured during aerobic exercies. Shin splints, tendonitis, stressed and sore joints, muscle trauma and ankle roll over are examples of the type of injuries which occur. Ultimately it is the floor that must [15] accept responsibility for reducing shock, promoting comfort and protecting against these injuries.

Various flooring systems have been developed to provide a cushioning effect. U.S. Pat. No. 3,684,630 discloses a steel floor having grooves cut into the steel [20] over a foam underlayer. A wear layer is placed over the steel. "The deeper the wear layer is depressed the greater is the tendency to rupture the wear layer and to crush the underlying material", according to the patent describing the mechanics of a wear material with limited [25] load distributing factors. For an exercise floor, the continuous flexing of the steel where the grooves have been cut could cause flex cracking of the joints. U.S. Pat. No. 3,388,516 discloses the use of corrugated steel as a cushioning material as an improvement over concrete. [30] U.S. Pat. No: 3,902,293 discloses bonded floor tile over a network of filaments containing spheroidal cells of gas as an improvement over bonding the floor tile directly to the sub

floor. The tile are locked together by tongue and groove on all four sides, or by adhesive. [35] U.S. Pat. No. 4,169,688 discloses an artificial ice skating ring floor on a layer of cushion material. The floor plates are held together by U shaped insertion members.

SUMMARY OF THE INVENTION

[40] The floor system of the present invention aids leg motion in both the lateral and vertical directions. In vertical motion the leg carries considerable energy against the surface. The floor system of the present invention absorbs the energy and deflects under the [45] impact to disperse the energy away from the legs and feet to reduce the shock of the impact. The floor system of the present invention is also firm enough to provide some rebound. Also, a firm surface stabilizes the feet and lessens the chance of ankle injury caused by foot [50] rollover.

The surface of the floor system of the present invention provides the proper traction for lateral and rotational motion to accomplish the necessary sliding, twisting and turning found in today's tough aerobic routines. [55] The preferred surface is a wood surface having a floating air cushioned suspension system to provide energy return qualities. In addition, the necessary traction for horizontal and rotational movement can be provided by appyling various types of finishes. And finally, wood is [60] much more hygienic and easier to maintain than carpet which harbors bacteria and odors that require cleaning with a hot-water extractor and sanitizer at least weekly.

The cushioned floor of the present invention is made up of a number of elements. A lower layer of a foamed [65] pad has a sufficient thickness and compressive strength that it will not bottom out i.e., it will always yield to static and impulsive loading when used by humans

doing exercise on the floor. An attrition resistant upper layer of boards joined at a pivoting tongue and groove joints provides an exercising surface. The lengthwise direction of the boards runs in the same direction as the [5] joints. A slot is provided in each board parallel to the joints. A U shaped spring clip having upright legs is inserted into the slots. One leg of the spring clip contains one or more cleats which protrude away from the direction of insertion of the legs and toward a wall of [10] one slot. The combined width of the cleat and the leg inserted in the slot are wider before insertion into the slot than the slot whereby the leg containing the cleats is locked into the slot into which it is inserted thus holding the spring clip in place. The boards arc held together [15] by tension in the spring clip, the spring clip being curved in the lengthwise direction between the legs when there is no load on the boards; so that when a load is applied and the boards flex, the curved portion straightens so as not to unduly restrain the joint from [20] flexing. While a minimum number of boards required to practice the present invention is two, in actual practice a plurality of boards is used to cover the entire exercise area, each board joined to each adjacent board by spring clips

[25] The foamed pad is inventive in its own right. The foamed pad has a thickness of about one half inch to about an inch and one half and a reaction to compressive loading of about 12 to 16 pounds per square inch at [30] 50% deflection. The pad preferable has at least two layers and more preferably three layers, one surface layer of which has a density of approximately one half the density of the opposed surface layer. The less dense side is the upper layer of the pad when placed under the [35] boards. The pad is preferably made of flexible closed, cell polyethylene foam which is crosslinked by electron irradiation.

The cleats of the spring clip are preferably formed from the material of the leg to which the cleats are [40] attached. The cleats form an angle of less than 90 degrees with the surface of the leg from which they were cut. The cleats preferably extend at an angle of from 25 degrees to 60 degrees from the surface of the leg to which the cleats are attached.

[45] Preferably the attrition resistant layer of boards of the floor are made of wood which has been press-dried with pressure on faces of the boards to reduce shrinkage in the face width.

The pad can also be used under a carpet as an exercise [50] floor though this is not preferred. When the multilayer pad is used under carpet the denser side is used as the top side of the pad.

BRIEF DESCRIPTION OF THE DRAWINGS

[55] FIG. **1** is an exploded view of the preferred exercise floor.

FIG. **2** is an end view of a section of the exercise floor.

FIG. **2A** is a view of the spring clip.

[60] FIG. **3** shows the deflection of the exercise floor during use.

FIG. **4** is a view of an exercise floor using a carpet.

DETAILED DESCRIPTION

[65] Referring now to the drawings. A bottom layer **11** is a pad made of flexible closed-cell polyethylene foam which is cross linked by means of an electron irradiation process. It is made as a continuous, smooth sheet with

[3]

small cells. The foam is in the form of a three layer pad **11**. The layers are one-fourth of an inch thick and thermally laminated to each other. The top layer **13** and center layer **15** each have a two pounds per square foot density, and the bottom layer **17** has a four pound per [5] square foot density. The pad **11** is resistant to high temperatures, has a very low water absorption capability, does not transmit moisture, has excellent thermal insulation characteristics and is resistant to most chemicals. The technical properties of the pad **11** are as follows.[10]

1. Compression Strength--12.7 to 15.5 pounds per square inch at 50 percent deflection.
2. Compressive Set--16 percent maximum of original thickness after 22 hours of loading and 24 hours of recovery.[15]
3. Tensile Strength----45 to 55 pounds per square inch.
4. Elongation--124 percent to 152 percent to break in the machine direction.
5. Tear Resistance--10 to 12 pounds per square inch in the machine direction.[20]
6. Shore Hardness--typical value of 7 on the AA scale.
7. Thermal Stability--1.5 percent maximum shrinkage over a three hour period with no load at 180 degrees Fahrenheit. [25]
8. Load Temperature Brittle Point--minus 110 degrees Fahrenheit.
9. Thermal Conductivity--0.25 BTU per hour, foot squared, degrees Fahrenheit per inch K factor at 7 degrees Fahrenheit.[30]
10. Water Absorption--0.04 pounds per square foot of cut surface.

Above the pad **11** is flooring **19**, which is a series of boards including boards **21**, **23** and **25**. The boards **21**, **23** and

25 are machined tongue and grooved, end-matched and assembled from contiguous and adjacent beech strips **27** and **29**. The strips **27** and **29** are assembled at the longitudinal joint **31** by means of a jointer using a double dovetail and permanently glued using a polyvinyl acetate adhesive centrally located in the [40] boards **21**, **23** and **25**. A standard grade of beech is used and each board **21**, **23**, and **25** is five and one sixth inches wide by twelve foot one and five eights inches long by seven eights of an inch thick. The boards **21**, **23** and **25** weigh 3.28 pounds per square foot. [45]

The beech flooring boards **21**, **23** and **25** are pressed-dried to stabilize the expansion thrust of the floor. The press drying process is a drying method by which heated plates having a temperature of 345 degrees Fahrenheit are pressed against the top and bottom face of [50] each flooring strip **27** and **29** at a pressure of 170 pounds per square inch. Through this drying process, shrinkage occurs only in the thickness and not in the face width, as pressed dried boards expand in the thickness first.

During the press drying process, the strength of the [55] beech is increased by 15 percent. The green beech is at a thickness of one and one fourth inches prior to drying. After the drying process the beech has been compressed to a nominal one inch in thickness. The specific gravity of the beech is increased by approximately 10 percent. [60] Therefore the press drying not only stabilizes the beech flooring **19**, but also increases the load bearing capability of the flooring **19**.

Each board **21**, **23** and **25** is sanded to a perfectly smooth seven eights inch thickness, and finished with 3 coats of two component polyurethane. The finish is automatically applied to the boards **21**, **23** and **25** in three treatments in a seal curtain coating plant which

[4]

gives the greatest possible uniformity in the thickness of the finish. Prior to applying the finish, the boards **21**, **23** and **25** are preheated with infrared rays so that the penetration of the lacquer into the grain of the wood is [5] considerably increased. This gives the highest durability and adhesion for the next coat of finish. To obtain the best results, the boards **21**, **23** and **25** are mechanically sanded before the second and third coat of finish is applied.

[10] The boards **23** and **25** are held together by spring clip **33**. Leg **35** of monolithic spring clip **33** is fast inserted into groove **37** of board **23**, and is locked in place by cleat **39**. Board **23** with spring clip **33** attached is then laid on pad **11**. Board **25** is then laid with leg **41** inserted [15] into groove **43**.

Foot pressure as shown in FIG. **3** pushes boards **23** and **25** down into pad **11**, and causes the curve **45** in spring clip **33** to straighten. Also tongue **47** and groove **49** rotate slightly with respect to each other. There is [20] sufficient freedom on play between tongue **47** and groove **49** so as not to restrain boards **23** and **25** from reacting to the pressure or to cause breakage of tongue **47**.

The flooring system can be installed over any level [25] subfloor in a day or two and can be disassembled and reassembled easily.

Referring now to FIG. **4**, a carpet **51** is laid over pad **11**. A carpet with a synthetic backing withstands constant cleaning and bacterial growth. One tenth gauge [30] and 24 to 26 ounce carpeting is advised for longest wear. Cut pile reduces friction and hides seams. Seams are heat sealed. A bacteriostat incorporated into the material of the carpet **51** inhibits bacterial growth.

Various modifications of the invention are possible [35] without departing from the scope of the appended claims.

I claim:

1. A cushioned floor comprising in combination:
a lower layer of a foamed pad having sufficient thickness [40] and compressive strength that it will always yield when used with static and impulsive loading caused by humans doing exercise on the floor; and
an attrition resistant upper layer of at least two distinct boards each board comprised of a pair of [45] adjacent contiguous strips, said strips joined to each other by a longitudinal dove tail joint centrally located in said board, said at least two distinct boards having at least one tongue and groove pivoting joint joined with play, said at least one [50] tongue and groove pivoting joint having one lengthwise direction, a slot running parallel to said lengthwise direction of said pivoting joint in alternate strips of said at least two distinct boards, a U-shaped resilient monolithic clip having upright [55] legs inserted into the slots overlapping and asymmetrical to said centrally located longitudinal dove tail joint, one leg of which contains at least one cleat which protrudes away from the directions of the legs and toward a wall of one slot, the combined [60] width of the cleats and the leg inserted in the one slot being wider thus the one slot before insertion into the slot whereby the leg containing said at least one cleat is locked into the slot into which it is inserted thus holding the spring clip in place, the [65] boards being held together by tension in the spring clip, the spring clip being curved in the lengthwise direction between the legs when there is no load on the boards;

[5]

so that when a load is applied and the boards flex, the curved portion straightens so as not to unduly restrain the joint from flexing.

2. A floor of claim 1 having a plurality of more than two boards, each board joined to each adjacent board [5] by one or more of the spring clips.

3. A floor of claim 1 wherein the foamed pad has a thickness of from one half to two inches.

4. A floor of claim 1 wherein the foamed pad has a [10] thickness of about three quarters of an inch and a compressive strength of about 12 to 16 pounds per square inch at 50% deflection.

[6]

5. A floor of claim 4 wherein the foamed pad comprises an upper layer and a lower layer, the upper layer of which has a density of approximately one half the density of the lower layer.

[5] 6. A floor of claim 1 wherein the foamed pad comprises flexible closed-cell polyethylene foam.

7. The floor of claim 1 wherein the one or more cleats are formed from the material of the leg to which the one or more cleats are attached, and the one or more cleats [10] form an angle of less than 90 degrees with a plane formed by an opening created by the formation of the one or more cleats.

* * * * *

APPENDIX K

Patents

and the

Federal Circuit

Sixth Edition

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[288]

its limitations, which give meaning to the various elements of the claim.[71] A court commits fundamental legal error when it analyzes each claim by a single word description of one part of the claimed invention. In patent law, a word means nothing outside the claim and the description in the specification. A disregard of claim limitations would render claim examination

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[71] *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994); *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082, 227 USPQ 337 (Fed. Cir. 1985).

in the PTO meaningless. If a court may so rewrite claims, the entire statutory-regulatory structure that governs the draining, submission, examination, allowance, and enforceability of claims would crumble.[72] There is no legally recognizable or protected gist or heart of the invention.[73] Reliance upon a finding that a "novel element" of a structural invention lies in the operation of a specification-described embodiment of the claimed structure would render meaningless the statutory requirement for claiming, the statutory requirement for treating claims individually, and the entire examination system centering on the allowance or rejection of claims.[74]

It cannot be said that a part of a claim is "claimed" subject matter. Claims, being definitions that must be read as a whole, do not "claim" or cover or protect all that their words may disclose. Even though a claim to an A-B-C combination of steps may contain a detailed description of step A, that does not give the patentee any patent right in step A alone and it is legally incorrect to say that step A is "patented."[75]

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[72] *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1 USPQ2d 1593 (Fed. Cir. 1987).

[73] *Everpure, Inc. v. Cuno, Inc.*, 875 F.2d 300, 10 USPQ2d 1855, 1857 (Fed. Cir. 1989); *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 309 (Fed. Cir. 1983). There is no such thing as a patented portion of a patented combination. *Porter v. Farmers Supply Serv., Inc.*, 790 F.2d 882, 229 USPQ 814, 816 n.4 (Fed. Cir. 1986).

[74] *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 227 USPQ 577 (Fed. Cir. 1985).

[75] *General Foods Corp. v. Studiengesellschaft Kohle mbH*, 972 F.2d 1272, 23 USPQ2d 1839 (Fed.Cir. 1992). Claims must be read as a whole in analyzing a defense of double patenting. *Id.*

(c) Specification

A technical term used in a patent document is interpreted as having the meaning that it would be given by persons experienced in the field of the invention, unless it is apparent from the patent and the prosecution history that the inventor used the term with a different meaning. Thus, it is always necessary to review the specification to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning.[76] The specification that is relevant to claim construction is the specification of the patent in which the claims reside.[77]

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The specification informs, but does not control, claim construction. Rather, the claim language itself governs the meaning of the claim.[78] Thus claims are always construed in

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[76] *CVI/Beta Ventures, Inc. v. Tura LP*, 112 F.3d 1146, 42 USPQ2d 1577 (Fed. Cir. 1997).

[77] *Young Dental Mfg. Co. v. Q3 Special Prods., Inc.*, 112 F.3d 1137, 42 USPQ2d 1589 (Fed. Cir. 1997). See also, e.g., *Rowe v. Dror*, 112 F.3d 473, 42 USPQ2d 1580 (Fed. Cir. 1997). In determining whether a patented invention is anticipated, the claims are read in the context of the patent specification in which they arise and in which the invention is described. *Glaverbel S.A. v. Northlake Mkt'g & Supp., Inc.*, 45 F.3d 1550, 33 USPQ2d 1496 (Fed. Cir. 1995).

[78] *Envirco Corp. v. Clestra Cleanroom Inc.*, 209 F.3d 1360, 54 USPQ2d 1449 (Fed. Cir. 2000).

light of the specification,[79] but that does not mean that the claims incorporate all disclosures of the specification.[80] Conversely, a patent claim should be construed to encompass at least one disclosed embodiment in the written description portion of the patent specification. This maxim flows from the statutory requirement that the specification shall contain a written description of the invention, which requires a patent applicant to disclose in the specification sufficient subject matter to support the breadth of the claims. A claim construction that does not encompass a disclosed embodiment is thus rarely, if ever, correct and would require highly persuasive evidentiary support.[81]

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[79] E.g., *D.M.I., Inc. v. Deere & Co.*, 755 F.2d 1570, 225 USPQ 236 (Fed. Cir. 1985).

[80] *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 7 USPQ2d 1057 (Fed. Cir. 1988); *Sjolund v. Musland*, 847 F.2d 1573, 6 USPQ2d 2020 (Fed. Cir. 1988); *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 228 USPQ 90 (Fed. Cir. 1985); *Lemelson v. United States*, 752 F.2d 1538, 224 USPQ 526 (Fed. Cir. 1985); *J.P. Stevens & Co. v. Lex Tex Ltd.*, 747 F.2d 1553, 223 USPQ 1089 (Fed. Cir. 1984); *Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 220 USPQ 592 (Fed. Cir. 1983). A court should not ordinarily rely on the preferred embodiments alone as representing the entire scope of the claimed invention. *CCS Fitness Inc. v. Brunswick Corp.*, 288 F.3d 1359, 62 USPQ2d 1658 (Fed. Cir. 2002).

[81] *Johns Hopkins Univ. v. Cellpro Inc.*, 152 F.3d 1342, 47 USPQ2d 1705 (Fed. Cir. 1998); *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 39 USPQ2d 1573, 1578 (Fed. Cir. 1996). A claim interpretation that excludes the preferred embodiment is rarely, if ever, correct. *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 45 USPQ2d 1498 (Fed. Cir. 1998). It is unlikely that an inventor would define the invention in a way that excludes the preferred embodiment or that those skilled in the art would read it

There is sometimes a fine line between reading a claim in light of the specification, and reading a limitation into the claim from the specification.[82] While examples disclosed in the preferred embodiment may aid in the proper interpretation of a claim term, the scope of a claim is not necessarily limited by such examples.[83] Thus, what is

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that way. *Hoechst Celanese Corp. v. BP Chem. Ltd.*, 78 F.3d 1575, 38 USPQ2d 1126 (Fed. Cir. 1996). A claim construction that would exclude the preferred embodiment described in the specification cannot be sustained. *Burke Inc. v. Bruno Indep. LivingAids Inc.*, 183 F.3d 1334, 51 USPQ2d 1295 (Fed. Cir. 1999). Despite these observations, the court in *Elekta Instr. S.A.v.O.U.R. Sci. Int'l Inc.*, 214 F.3d 1302, 54 USPQ2d 1910, 1914 (Fed. Cir. 2000), concluded that it was dealing with the rare case in which the only correct interpretation was one that excluded the only disclosed embodiment.

[82] *Comark Comm. Inc. v. Harris Corp.*, 156 F.3d 1182, 48 USPQ2d 1001, 1005 (Fed. Cir. 1998). But mere observation by the district court that the written description discloses only a particular structure does not constitute reading that structure into the claims as a limitation. It is entirely proper to use the specification as a starting point for construing disputed language. *Laitram Corp. v. Morehouse Indus. Inc.*, 143 F.3d 1456, 46 USPQ2d 1609 (Fed. Cir. 1998).

[83] *Ekchian v. Home Depot, Inc.*, 104 F.3d 1299, 41 USPQ2d 1364 (Fed. Cir. 1997). Claims, not the specification embodiments, define the scope of the protection. *American Perrnahedge, Inc. v. Barcana, Inc.*, 105 F.3d 1441, 41 USPQ2d 1614 (Fed. Cir. 1997). It is not true that where only one embodiment is disclosed in the specification, claim terms are limited to the embodiment disclosed. The number of embodiments disclosed in the specification is not determinative of the meaning of disputed claim terms. *Teleflex Inc. v. Ficosa North Am. Corp.*, 299 F.3d 1313, 63 USPQ2d 1374 (Fed. Cir. 2002).

[290]

patented is not restricted to the examples but is defined by the words in the claims if those claims are supported by the specification. Where a specification does not require a limitation, that limitation should not be read into the claims.[84] While it is entirely proper to use the specification to interpret what the patentee meant by a word or phrase in the claim, this is not to be confused with adding an extraneous limitation appearing in the specification, which is improper.[85] If everything in the specification were required to be read into the claims, or if structural claims were to be limited to devices operated precisely as a specification-described embodiment is operated, there would be no need for claims. Nor could an applicant, regardless of the prior art, claim more broadly than that embodiment. Nor would a basis remain for the statutory necessity that an applicant conclude the specification with claims particularly pointing out and distinctly claiming the subject matter that the applicant regards as his or her

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[84] *Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 6 USPQ2d 1601, 1604 (Fed. Cir. 1988). The fact that the examples showed only external plasticizers did not mean that the word "plasticizer" in the claims should be read to exclude internal plasticizers, where there was other evidence of record to support a broader interpretation. Also, some narrower dependent claims included external plasticizers as a limitation, so that limitation should not be read into the broader independent claims.

[85] *E.I. duPont & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 7 USPQ2d 1129 (Fed. Cir. 1988). By "extraneous" is meant a limitation read into a claim from the specification wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claim. *Id.*

invention.[86] Just because a patent is narrow does not mean that the claims are to be limited to the specific embodiments disclosed in the specification.[87]

Nonetheless, it would run counter to the requirement that a claim particularly point out and distinctly claim the invention were an inventor to expressly state, throughout the application and claims, that the invention includes a particular limitation, and then be allowed to avoid that limitation in a later infringement suit by reference to one paragraph in the specification that states an alternative lacking that limitation.[88] All rules of construction must be understood in terms of the factual situations that produced them, and applied in fidelity to their origins. Thus, it is true that the description of the preferred embodiment in the specification does not limit the claims to that embodiment. However, when the preferred

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[86] *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 227 USPQ 577, 585 (Fed. Cir. 1985).

[87] *Aktiebolaget Karlstads v. United States ITC*, 705 F.2d 1565, 217 USPQ 865 (Fed. Cir. 1983). References to a preferred embodiment, such as those often present in a specification, are not claim limitations. *Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 9 USPQ2d 1289 (Fed. Cir. 1988). However, one cannot interpret a claim to be broader than what is contained in the specification and claims as filed. *Tandon Corp. v. United States ITC*, 831 F.2d 1017, 4 USPQ2d 1283 (Fed. Cir. 1987). Although the specification may well indicate that certain embodiments are preferred, particular embodiments appearing in the specification will not be read into the claims when the claim language is broader than such embodiments. *Electro Med. Sys. S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 32 USPQ2d 1017 (Fed. Cir. 1994).

[88] *Unique Concepts, Inc. v. Brown*, 939 F.2d 1558, 19 USPQ2d 1500 (Fed. Cir. 1991).

embodiment is described in the specification as the invention itself, the claims are not necessar-

[291]

ily entitled to a scope broader than that embodiment.[89] Where the specification makes clear that the invention does not include a particular feature, that feature is deemed to be outside the reach of the claims of the patent, even though the language of the claims, read without reference to the specification, might be considered broad enough to encompass the feature in question.[90] It is a truism that a claim need not be limited to a preferred embodiment. However, in a given case, the scope of the right to exclude may be limited by a narrow disclosure. In sum, the cases do not stand for the proposition that an applicant can broaden his or her claims to the extent that they are effectively bounded only by the prior art. Rather, they make clear that claims may be no broader than the

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[89] *Modine Mfg. Co. v. United States ITC*, 75 F.3d 1545, 37 USPQ2d 1609, 1612 (Fed. Cir. 1996). Here the specification was amended to change an original range of.015-.070 to a smaller range of .015-.040 inch. Thus, the claimed limitation "relatively small" was held not to extend to .070 inch. However, this did not preclude an attempt to show literal infringement for dimensions over .040 or to establish equivalency.

[90] *SciMed Life Sys. Inc. v. Advanced Card. Sys. Inc.*, 242 F.3d 1337, 58 USPQ2d 1059, 1062-63 (Fed. Cir. 2001). In *Honeywell Inc. v. Victor Co. of Japan Ltd.*, 298 F.3d 1317, 63 USPQ2d 1904 (Fed. Cir. 2002), the court distinguished *SciMed* on the ground that the patent in suit, unlike that in *SciMed*, did not contain explicit language disclaiming certain subject matter.

supporting disclosure, and therefore that a narrow disclosure will limit claim breadth.[91]

Claim terms cannot be narrowed by reference to the written description or prosecution history unless the language of the claims invites reference to those sources. In other words, there must be a textual reference in the actual language of the claim with which to associate a proffered claim construction. The case law demonstrates two situations where a sufficient reason exists to require the entry of a definition of a claim term other than its ordinary and accustomed meaning. The first arises if the patentee has chosen to be his or her own lexicographer by clearly setting forth an explicit definition for a claim term. The second is where the term or terms chosen by the patentee so deprive the claim of clarity that there is no means by which the scope of the claim may be ascertained from the language used. In these two circumstances, a term or terms used in the claim invites--or indeed, requires--reference to intrinsic, or in some cases, extrinsic evidence to determine the scope of the claim language.[92] A party wishing to use statements in the written description to confine or otherwise affect a patent's scope must, at the very least, point to a term or terms in the claim with which to draw in those statements. Without any claim term that is susceptible of clarification by the written description, there is no legitimate way to narrow the property right. If one need not rely on a limitation to interpret what the patentee meant by a particular term or

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[91] *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 45 USPQ2d 1498 (Fed. Cir. 1998).

[92] *Johnson Worldwide Assoc. Inc. v. Zebco Corp.*, 175 F.3d 985, 50 USPQ2d 1607, 1610-11 (Fed. Cir. 1999).

phrase in a claim, that limitation is "extraneous" and cannot constrain the claim.[93]

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Courts cannot alter what the patentee has chosen to claim as the invention. No matter how great the temptations of fairness or policy making, courts do not rework claims. They only interpret them.[94]

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[93] *Renishaw plc. v.. Marposs Societa' per Azione*, 158 F.3d 1243, 48 USPQ2d 1117 (Fed. Cir. 19981. It does not necessarily follow that nonnumerically limited descriptive terms, such as "substantially uniform," are defined according to the purpose of the invention. When the function served is not recited in the claim itself, it is not imported as a limitation. *Ecolab Inc. v. Envirochem Inc.*, 264 F.3d 1858, 60 USPQ2d 1173 (Fed. Cir. 2001).

[94] *Intervet Am., Inc. V. Kee-Vet Labs., Inc.*, 887 F.2d 1050, 12 USPQ2d 1474 (Fed. Cir. 1989). It is incorrect to construe the claims contrary to the specification, and then to hold the claims invalid because they are contrary to the specification; the claims are construed in accordance with the rest of the specification of which they are a part, and not contrary to it. *C.R. Bard Inc. v. M3 Sys. Inc.*, 157 F.3d 1340, 48 USPQ2d 1225 (Fed. Cir. 1998). In *Becton Dickinson & Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 17 USPQ2d 1097 (Fed. Cir. 1990), the district court reworked the claims to an extent that the Federal Circuit was moved to characterize as reflecting an "egregious misunderstanding of the law." On summary judgment, independent claim 1 was found not invalid but also not infringed, while independent claims 6 and 7 were found invalid for obviousness. The district court then proceeded to rewrite claims 6 and 7 as though they were dependent upon claim 1 and concluded that such hypothetical claims would be valid but not infringed, for the same reasons as claim 1.

Cautionary note. Despite the Federal Circuit's repeated protestations to the contrary, the author has come to the belief that sometimes it does in fact import limitations from the specification into the claims. In other words, it limits the claim coverage to the embodiment described in the specification without any articulable legal justification. In certain cases, the author has been entirely unable to discern a clear indication, in the patent documents, that the preferred embodiments has been described "as the invention itself," or to see how a person skilled in the art would understand that the inventor intended such a limitation. And yet the claims have been construed to be limited to that embodiment.

The author fully expects that the court, were it ever to be confronted with this view, would firmly disagree. Indeed, many or most practitioners might feel the author has misread the decisions. Nonetheless, the author feels strongly enough about this conclusion that he feels obliged to state it, and to offer some examples. Accordingly, those readers who are interested in the topic are invited to read and analyze the cases collected in the footnote,[95] and to make their own judgments.

The author also believes that the Federal Circuit is developing alternative techniques to achieve the same end

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[95] *Bell Atl. Network Serv. Inc. v. Covad Comm. Group Inc.*, 262 F.3d 1258, 59 USPQ2d 1865 (Fed. Cir. 2001); *Netword LLC v. Centraal Corp.*, 242 F.3d 1347, 58 USPQ2d 1076 (Fed. Cir. 2001); *SciMed Life Sys. Inc. v. Advanced Card. Sys. Inc.*, 242 F.3d 1337, 58 USPQ2d 1059 (Fed. Cir. 2001); *Globetrotter Software Inc. v. Elan Computer Group Inc.*, 236 F.3d 1363, 57 USPQ2d 1542 (Fed. Cir. 2001); *Watts v. XL Sys. Inc.*, 232 F.3d 877, 56 USPQ2d 1836 (Fed. Cir. 2000); *Wang Labs. Inc. v. America Online Inc.*, 197 F.3d 1377, 53 USPQ2d 1161 (Fed. Cir. 1999); *Toro Co. v. White Consol. Indus. Inc.*, 199 F.3d 1295, 53 USPQ2d 1065 (Fed. Cir. 1999).

result, i.e., no liability for infringement. See the discussion of *Gentry Gallery* in §5.4(e).

(d) Title, Abstract, and Drawing

The title of a patent appears to be nearly irrelevant to claim construction. Certainly, MPEP §606.01 provides that the examiner

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may require a change in the title if the proffered title is not descriptive of the invention claimed. However, it goes on to explain that "this may result in slightly longer titles, but the loss in brevity of the title will be more than offset by the gain in its informative value in indexing, classifying, searching, etc." Thus, as indicated by the MPEP itself, the purpose of the title is not to demarcate the precise boundaries of the claimed invention but rather to provide a useful reference tool for future classification purposes. In any event, if courts do not read limitations into the claims from the specification that are not found in the claims themselves, then they certainly will not read limitations into the claims from the patent title. Consequently, an amendment of the patent title during prosecution should not be regarded as having the same or similar effect as an amendment of the claims themselves by the applicant.[96] Despite the statement in PTO Rule 72(b) that the "abstract shall not be used for interpreting the scope of the claims," the court is willing to use the abstract as a source of intrinsic evidence as to the meaning of claims. It seems to feel

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[96] *Pitney Bowes Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 51 USPQ2d 1161, 1170-71 (Fed. Cir. 1999). See also *Moore USA Inc. v. Standard Register Co.*, 229 F.3d 1091, 56 USPQ2d 1225 (Fed. Cir. 2000).

that the rule is one that governs the conduct of patent examiners and does not address the process by which courts construe claims in infringement actions.[97]

It is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.[98]

(e) Prosecution History

The prosecution history can be utilized as a claim construction tool apart from the pure estoppel context (see §8.2).[99] Prosecution history is an important source of intrinsic evidence in interpreting

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[97] *Hill-Rom Co. v. Kinetic Concepts Inc.*, 209 F.3d 1337, 54 USPQ2d 1437, 1440 n.1 (Fed. Cir. 2000). See also *SciMed Life Sys. Inc. v. Advanced Card. Sys. Inc.*, 242 F.3d 1337, 58 USPQ2d 1059 (Fed. Cir. 2001).

[98] *Hockerson-Halberstadt Inc. v. Avia Group Int'l Inc.*, 222 F.3d 951, 55 USPQ2d 1487 (Fed.Cir. 2000). Thus, a reasonable competitor, being aware that figures in a patent are not drawn to scale unless otherwise indicated, would understand arguments in the prosecution history that clearly disclaim a particular construction even though those arguments might appear erroneous in light of the drawings. *Id.*

[99] *Advance Transformer Co. v. Levinson*, 837 F.2d 1081, 5 USPQ2d 1600 (Fed. Cir. 1988); *Moleculon Res. Corp. v. CBS, Inc.*, 793 F.2d 1261, 229 USPQ 805 (Fed. Cir. 1986); *McGill Inc. v. John Zink Co.*, 736 F.2d 666, 221 USPQ 944 (Fed. Cir. 1984). In *Jurgens u. McKasy*, 927 F.2d 1552, 18 USPQ2d 1031 (Fed. Cir. 1991), the court placed heavy emphasis on the examiner's reasons for allowance and the prosecuting attorney's apparent agreement with the examiner's claim interpretation as expressed in those reasons.

APPENDIX L

In Re:Certain Flooring Products
No. 337-TA-443
July 26, 2001

Open/Closed Session

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Q. Now, you said that you sent your father more drawings during the first part of 1994?

A. Yes, that is correct.

Q. What kind of advancements were you making in terms of this invention you were working on or this project you were working on?

A. Well, I refined the locking system, and made some additions on it. For example, I added one more installation method that wasn't in the original Swedish application, and that is, well, more or less the same method that is described in the '907 patent in the U.S. right now. I also added some extra feature with the aluminum, where I made a solution where the aluminum strip, where mechanical attached to the floor board. In the Swedish patent, I have only glued it on the patent. So I made some - well, I made some refinements.

Q. Did you study different ways to configure the joint in different ways to join the patents during that period?

A. Yes, I had to think of several ways of how to join them together, snapping and angling and sliding and I had to think because I wanted to have - well, I wanted actually to have as good PCT application, I wanted that to be, well, include as much of my invention as possible.

Q. Did you come to any conclusions as to the best way

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to make the product, that is the mechanical joint you were working on or the best way to assemble the panels?

A. Yes, I had to think because the patent agency told me that I was supposed to show the best, the best way, the best embodiment of the invention. And I had during this period noticed that if you include, if you include the small distance or play in the product, that will somewhat facilitate or make it easier to angle the product up and that of course would make it easier to release of disassemble. And it also facilitates somewhat the sliding of the product.

So I decided to include that in the PCT application because, well, I was told as I said to show the best embodiment, and I, at that time, thought that this was a good solution.

Q. So the concept of play is something that came up as you were working in the early part of '94 in connection with this design you were working on?

Mr. DIMATTEO: Objection, Your Honor, leading.

JUDGE LUCKERN: Sustained, Go ahead. Ask your next question.

BY MR. O'CONNOR:

Q. Did you – strike that.

I believe in your last answer, you used the word "play'?

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A. I used the word "play," yes.

Q. And what did you mean by that word?

A. The play, that is very, very small distance that you create between two surfaces. And the purpose of that is to, well, separate the surfaces somewhat. An example would be a piston in the cylinder, where you have a very small, small gap around the cylinder – the piston in order to, well, facilitate the movement.

So for me, for me, play is a very tiny space.

Q. You told us a minute ago about your Swedish application and the method that was disclosed in that application. I think you described it for the Court.

A. Yes.

Q. Could you describe that again, please?

JUDGE LUCKERN: Off the record.
(Discussion off the record)

JUDGE LUCKERN: Let's go back on the record. The question was: "You told us a minute ago about your Swedish application and the method that was disclosed in that application. I think you described it for the Court."

"Answer: Yes."
"Question: Could you describe that again, please?"

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THE WITNESS: I will try to describe the method disclosed in the Swedish patent. And that is a method where you – you place, I call it the angle slide snap method. And this is because you perform that movement with the board that you install.

So you take a board and put it close to the board in front of it, in an angle, and hen you angle it down and then when it has entered a horizontal plane somewhat, you push it and slide it until the short end will connect. So therefore, you have the

angle slide and then you snap, you the angle the long side and you slide it until the short side will snap.

BY MR. O'CONNOR:

Q. And did your work in the early part of '94 result in any additional methods on joining, in addition to that method that you just described that was in the original Swedish application"

Q. In the spring of '94.

A. Yeah, then I had added more, several more – then I had added an additional method for installing it.

Q. What was that method?

A. That method was when you start with the short side, and you start to connect two boards by the short sides, and I referred to that angle – the angle

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slide and angle method, because you angle in the short side of the floor panel and angle it down, and then slide it and angle again.

Q. Now, you said that your father asked you to generate more drawings in the first part of '94, correct?

A. Yes, that is correct.

Q. And did you prepare drawings and additional drawings and send them to your father?

A. Yes, I prepared several drawings and sent them to my father.

Q. by the way, the work you did during this phase, that is the early part of '94, did you use the same methodology that you had used the year before, that is this computer program methodology for studying the project?

A. Yeah. My way of engineering is my computer, so that is how I worked.